A study on mobile devices used by individuals for formal learning

Master Research Report

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Statement of authenticity

By submitting this work, I declare that this work is entirely my own except those parts duly identified and referenced in my submission. It complies with any specified word limits and the requirements and regulations detailed in the course work instructions and any other relevant programme module declaration. In submitting this work, I acknowledge that I have read and understood the regulations and code regarding academic misconduct, including that relating to plagiarism, as specified in the programme handbook. I also acknowledge that this work will be subject to a variety of checks for academic integrity.

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Ko te wehi ki te Atua, te tīmatanga o te whakaaro nui.

Whakahōnore te Kingi e tū nei i runga i te taupiritanga o te Kīngitanga. Pai mārire.

He whakatauākī: Ehara taku toa i te toa takitahi, engari he toa takitini – This is not an individual's success, but rather the success of a collective.

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Tēnā tātou katoa.

Abstract

Numerous portable, handheld devices are often called mobile devices. These mobile devices are ever-present and ubiquitous in the current age. Mobile devices are affecting the many aspects of life for individuals and have unsettled various old tasks, tools, activities with their reformation and redefinition of use and definitions. These mobile devices hold powerful computation capabilities built within a small physical frame that produces and provides a wide range of communication usage and possibilities. Furthermore, these devices are equipped with an intuitive operating system to interact with a large number of applications, sensors and other aspects of mobile devices. Within the realms of possibility, these devices can be useful to people for learning and studying formally, due to their versatility to suit learning preferences.

The TAM model, Technology Acceptance Model, was selected and used in an attempt to explain the elements that can change or influence the usefulness and usability of mobile devices in a formal and traditional learning context. The studies hypotheses are towards the capabilities and its technologies, which influence the acceptance of mobile devices as learning tools and thus influence the variables in the TAM model.

A survey was developed, pre-tested and redesigned before distribution. The final version of the survey was deployed and made public via a popular social media platform, Facebook. After four weeks, 41 responses were collected. Those responses were coded, and quantitative and qualitative analyses were used to find meaning and patterns within the data.

After the completion of the analyses, the findings reveal that devices (laptops, smartphones and tablets) are used regularly for formal learning and can be used to support learning and enhance learning productivity. As devices are used regularly, the findings indicate that laptops are much more suitable for learning compared to smartphones and tablets. The findings indicate that many kinds of apps are used for learning purposes, with tools, education, books and reference having been deemed most favourable among participants.

Keywords: Mobile devices, TAM model, mobile learning, formal learning, mobile apps, laptops, smartphones, tablets.

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Glossary

4G and 3G: Fourth and third generations of broadband cellular network

Apps: software application

AR: Augmented reality

Camtasia: streaming and video tool

ITP: IT professional

M-learning: Mobile learning.

Moodle: Modular Object-Oriented Dynamic Learning Environment, an online educational platform

SCT: Social cognitive theory

SMS: Short messing services

TAM model: Technology Acceptance Model.

UTAUT: Unified theory of acceptance and use of technology

VLE: Virtual learning environment

VR: Virtual reality

WIFI: Wireless fidelity

1 Introduction

There are devices in the current era that are easily transportable and mobile with wireless computing capabilities that are widely recognised as mobile devices. The use of mobile devices such as tablets, laptops, smartphones and other portable devices for learning is encouraged and supported by plentiful existing and current literature that is available. These mobile devices have a large number of apps and technologies built into the devices. Because of these apps and technologies, mobile devices are changing how simple daily tasks are performed and accomplished. Furthermore, these daily tasks can be associated with formal learning and therefore, is impacting and affecting how individuals learn formally. Current research and literature posit that the use of devices can cause positive effects in formal learning due to its versatility.

There is always something new to learn, and with the use of devices, (formal) learning is taken to another level as devices can support and aid students. For example, using devices will: give access to digital and online libraries to seek out books and journals, record lectures and note-taking, write and edit reports, and perform simple to complex calculations; thus, making devices useful and helpful. These devices can lessen the work or study stress and provide a better learning approach and experience can affect a person's academic journey. However, there are potential effects when learning with mobile devices. On one side, these devices enable data and information transfer more straightforward and more unadorned; on the other hand, devices can be distracting due to push notifications for social media posts and online games.

Based on the use of devices, and the effects it causes, this research aims to explore and determine the effective use of mobile devices for formal learning by finding out what kind of mobile devices/app(s) are utilised. The objectives of this work are to find the:

- Usefulness of mobile devices
- Reasons why mobile apps and devices are used
- Capabilities mobile devices provide that makes learning more accessible
- Kinds of apps that are used or can be used for learning
- Supportive roles the devices have when individuals are learning
- How these mobile devices are used
- Finding out if mobile devices provide individuals with various ways of learning

- The most common devices selected to be used for learning.

Therefore, based on the above statements, the main question for this research is,

What elements can affect people learning when using mobile devices?

The sub-questions are attempts in identifying the elements that mobile devices present that influences people to use said devices and thus, the following are the sub-questions:

- What mobile apps can be used for learning?
- How are devices used for learning?
- Why are apps/devices used for learning?
- What mobile devices are preferred for use when learning?

Pondering on the questions above lead to the following hypotheses:

- Mobile devices are useful when learning in a formal environment
- Mobile devices make learning less challenging in a formal setting
- Mobile devices support learning in a formal environment
- Mobile devices do offer a wide range of learning approaches in a formal environment.

A quantitative method is selected for this study, using a survey approach. This approach allows the author to design and distribute an online survey to a sample set of a population to analyse and describe the attitudes and ideas of said population. In this procedure, the author survey researchers collect quantitative, numbered data using questionnaires and statistically analyses the data to describe trends and themes based on the answers from the survey to prove or support the research question(s) or hypotheses.

Figure 1 shows that the structure of this research report is divided into seven sections. The report starts with Section 1.0 introducing and describing the research, the research aim, the questions, the hypotheses, and the research method.

Section 2.0 is the literature review; the aim in this section is to research and review literature that is currently available to understand and know more about learning with mobile devices. Literature review protocol is used to gather articles pertaining to the research topic. Section 2.1 is the introduction to the literature review. Section 2.2 describes mobile learning. Section 2.3 discusses what mobile devices are identified and also the technologies that these devices have. Section 2.4 focuses on learning with devices in a formal learning setting and how these

devices are used to support individuals learning needs. This section is broken into sub-sections. Section 2.4.1 describes formal and informal learning settings. Section 2.4.2 covers the role and influence gender may have where learning with devices is concerned. Section 2.4.3 describes the usefulness of mobile devices for learning purposes. Section 2.4.4 covers the potential mobile devices offer that can affect students learning in a formal environment. Section 2.4.5 conveys the challenges and difficulties mobile devices pose that can also affect the learning of students, such as multi-tasking. Section 2.5 concludes the findings from articles and other sources.

Section 3.0 is the research methodology, with it being divided into nine areas. Section 3.1 identifies the objectives of the research. Section 3.2 explains the establishment of the leading research question as well as the minor or sub-questions. Section 3.3 describes the development of hypotheses. Section 3.4 illustrates the theoretical model and depicts the relationship the model has to the hypotheses, sub-questions and the main research question. Section 3.5 explains and justifies the selected philosophical paradigm. Section 3.6 elucidates the selected research design. Section 3.7 identifies the method used and describes the questions that were present in the survey as well as detailing the structure of the questions. Section 3.8 describes reliability. Section 3.9 shares the validity of the research

Section 4.0 explores the analysis of the data from the online survey. This is divided into two areas: Section 4.1 addresses the quantitative analysis of the data; descriptive statistics. Section 4.2 addresses the qualitative analysis of the data; participant sub-group stories

Section 5.0 is the discussion portion of the report in which the author discusses the analysed data to discover meaning and understanding of the data in order to answer the questions that are developed. This section is divided into four areas: Section 5.1 discusses information derived from the literature on the research topic. Section 5.2 discusses information from the quantitative analysis. Section 5.3 discusses the information from the qualitative analysis. Section 5.4 discusses the findings of the literature, as well as the quantitative and qualitative results, to find what is similar and dissimilar between the literature and quantitative/qualitative results.

Section 6.0 is the final section of the report to conclude if the results provide a satisfactory answer to the research question.

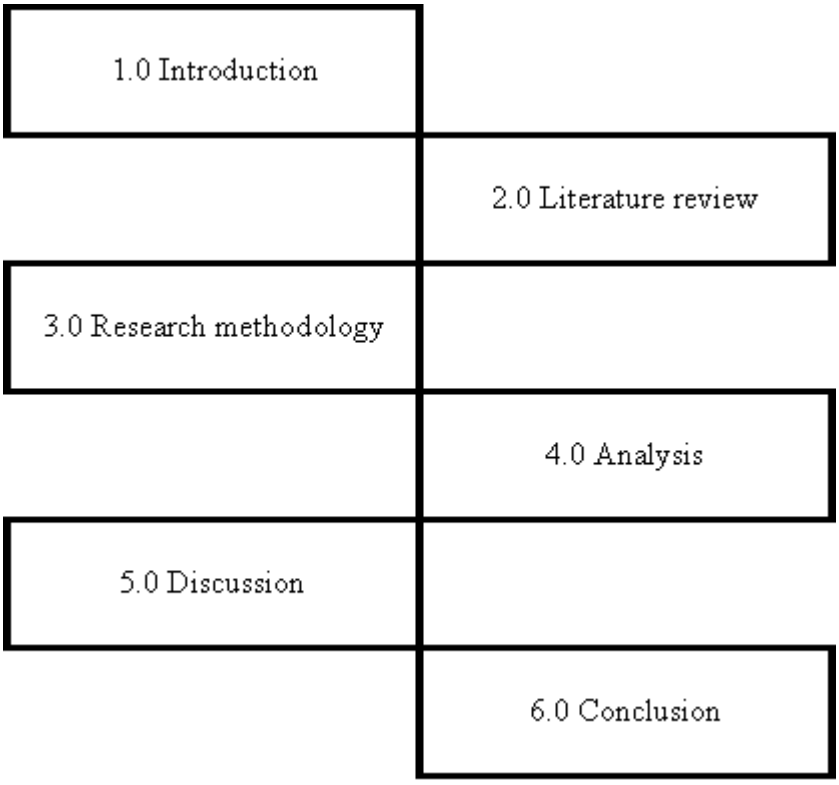


Figure 1. The structure of the research report

2 Literature review

A literature review examines academic articles, books and other sources in relation to an area of interest or research. The literature review then provides a description of the writing and works in relation to said research or interest. Literature reviews are aimed at providing a review of many sources the author has explored while studying and researching the topic of interest/research.

Figure 2 shows the areas that the literature covers. Such areas include sources and processes, the bias present in surveys, mobile learning, the devices and other technologies associated with mobile devices and learning with mobile devices, learning with mobile devices, the difference in informal learning and formal learning settings, the use of mobile devices and gender, the usefulness of devices, the potential devices present for formal learning both positive and negative potential.

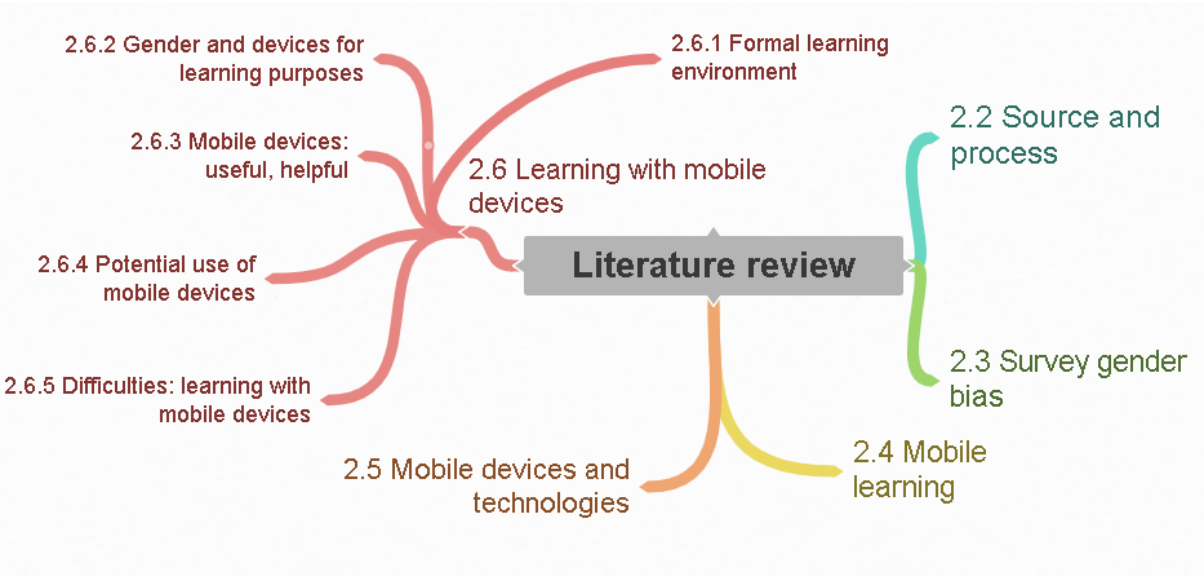


Figure 2. Literature review map

A protocol was developed to find academic papers on the research topic. The protocol describes the processes that are used to initiate a literature review. Furthermore, the protocol reduces the potential of researchers bias (Kitchenham et al., 2007).

The WINTEC One search was used to retrieve academic papers. The WINTEC One search is a comprehensive and sophisticated searching tool that allows users to search and retrieve

sources and material in academic journals and papers, magazines and other online resources as the One Search is linked to various datasets (WINTEC, 2019). The following datasets are linked with the WINTEC One Search: EBSCO Host, ScienceDirect, ProQuest.

Other search engines and datasets were used, such as Google scholar, ACM digital library, Springer link, ijet journal database, IGI Global, and information science. As sophisticated as the WINTEC One Search is, some articles were not listed or made available in the One Search datasets.

Table 1 depicts the datasets, where papers relating to this literature were found. Such documents are both journal articles and conference papers that were made available.

Table 1.

Table of datasets for papers and number of articles

Datasets	Journals articles	Conference papers	Number of articles
EBSCOHost	✓		5
ScienceDirect	✓	✓	25
ProQuest	✓		1
ACM digital library	✓		1
Springer link	✓	✓	9
Google scholar	✓	✓	25
ijet journal database	✓		4
IGI global	✓		2
Information science	✓	✓	6

Table 2.

Protocol for literature review

Background	M-learning is a learning opportunity available via various forms of mobile devices. The literature will address areas such as mobile devices and what sort of devices are used, the limitations and advantages of said devices. The purpose of the protocol is to review articles and papers that address m-learning and how mobile devices and its' elements can influence the learning aspect of an individual.
Research question(s)	• What mobile apps can be used for learning? • How are devices used for learning? • Why are apps/devices used for learning? • What mobile devices are preferred for use when learning?
Search strategy	The search with keys words: (m-learning or mobile learning or mobile device learning) OR (mobile technology in education or Mobile and blended learning) AND (learning or education or studying or academic). The researcher will use the WINTEC one search (with the following datasets: EBSCOHost, ScienceDirect, ProQuest, ACM Digital library). First preference will be to articles from the following journals: Journal of mobile and blended learning, Journal of computing and education, Journal of information systems and education, International Journal of interactive mobile technologies, Journal of educational technology, Computers and education. If the minimum number of references is not achieved then the following search strategy is applied, using Google Scholar, Microsoft academic search engine, ResearchGate, ACM DL, Otago Archives, AUT Open Thesis & Dissertations, Waikato University Research Repository and Semanticscholar.org.

Study selection criteria	Peer-reviewed articles published between 2003 – 2019.
The primary study selection process	To maintain focus on the primary topic of the literature as well as ensuring that the main topic is constant throughout the literature, the researcher will use a checklist. Inclusion criteria are as follows: • Articles exceed 2000 words • Articles are peer-reviewed • Use of mobile devices (smartphones, tablet, laptops) for formal learning • Mobile devices and learning with devices as a primary focus • Published in a credible peer-reviewed journal • Articles with 30 + references
Quality assessment	A checklist will be used to assess the quality of the articles • The literature is a structured article. • The literature presents relevant information. • The literature has quality references. • The topic of the literature is described.
Data extraction strategy	Academic articles. The data extracted from the articles will be: • Journal name and article title • Author and date • Abstract or summary • Main topic and objectives (include research question/issues) • Conclusion • Main finding • Keywords
Data synthesis	Articles will be reviewed and used to answer the questions, as well as refining the framework of the researcher before submission.

Dissemination	All results will be fully documented as a research report using Microsoft word and should be of interest to individuals wanting to read into mobile devices and learning.

2.1 Literature review introduction

Mobile devices are identified as devices “on the go”, hence mobile. Often these mobile devices are described as small handheld wireless devices such as phones, tablets, mini laptops; however, this also extends to notebooks, laptops, and other devices that can be mobile or portable. These mobile devices can be connected to a network such as the Internet (Ali, Mbabazi, Lawrence, & Geoffrey, 2017). Moreover, these devices are found everywhere and used in one’s day-to-day activities (Becker, Pernsteiner, & Drum, 2018).

Mobile learning allows individuals to use mobile devices to help with their learning goals in a formal learning environment (Kumar & Mohite, 2018). Additionally, as the critical word is mobile, mobile learning not just refers to mobile devices used for learning purposes, but to learn "on the go" using these mobile devices (Alsaadat, 2017). Mobile learning presents students and learners alike with an approach to access information no matter where the students or learners are located as long as there is Internet accessibility (Foti & Mendez, 2014).

Mobile technologies. These mobile devices are equipped with various technologies such as cameras, microphones, speakers, sensors and detectors GPS, connection technologies like Bluetooth, 3G, 4G, and touchscreen. Furthermore, there are also applications that further enhance and extend the capabilities of these mobile devices such as email, audio and visual recordings and productivity software (Haßler, Major, & Hennessy, 2016; Wu et al., 2012).

Learning is part of daily life. There is always something to learn each day directly or indirectly, formally or informally. Formal learning refers to a learning space with learning resources (Grant, 2015), which are designed by education providers in Secondary and Tertiary settings (Grant & Hsu, 2014). Informal learning often indicates individuals learning from day-to-day tasks and activities. Also, informal learning is seen as an unstructured way of learning without a tutor or teacher (Gikas & Grant, 2013). Using mobile devices enhances the learning experience for individuals, as most information is a click or tap away.

Many people have mobile devices in their possession. These devices are useful and helpful for learning. Mobile devices allow individuals to access content/course material or information for research purposes, communicate and collaborate with other individuals or tutors, and/or use the microphone functions to record (Farley et al., 2015). Since mobile technologies are always developing and improving, mobile devices have the potential to offer a broader range of learning opportunities, styles and approaches (O'Connor & Andrews, 2018).

Mobile devices can save time and lessen the stress of the student, because they can be used to research for information, find reading material, directly communicate with other associates or tutors, view grades and marks, and access course modules. Using the in-built functions in mobile devices can aid to further lessen the stress on students in many ways. For example, using word processors to compile report documents, using multi-media functions such as cameras or voice recorders to capture and record notes. Storing large quantities of notes via the cloud, that all devices can be synced to, can also aid in reducing stress on students, as mobile devices are not required to be fixed in a single location Also, these mobile devices permit individuals to view and work with their timetables, schedule appointments, as well as identify which lecture hall their classes are in, and so on (Fojtik, 2015).

As stated, various technologies are embedded in mobile devices. These mobile devices are used in daily activities as well as for learning in activities (Al-Zahrani, 2016). Because of that, there is potential for mobile devices and technologies to be used for learning purposes. Such potential includes, but is not limited to, VLE, VR and AR, improved collaborative learning via web communication and social media platforms (Van Raaij & Schepers, 2008). Mobile devices can provide the capability to alter and adapt to the needs of the learner or students. For example, education providers could develop applications tailored towards their specific teaching modules by using the in-built functions available in many mobile devices such as speakers, microphones and SMS, or text messaging, to improve the diction, grammar and spelling of a language by their students (Munday, 2016).

There are difficulties associated with mobile devices and their technologies, such as device size and WIFI connection (O'Connor & Andrews, 2018). Pedro, Barbosa, and Santos (2018) stated that devices are more distracting to students due to the constant pop-up notification like low-battery, social media and other forms of pop-up notifications. Other difficulties when learning with devices is the multi-tasking capabilities; these devices allow people to perform

more than two tasks at the same time, which can lessen productivity as well as reducing efficiency in fully completing tasks. As mobile devices become more sophisticated and complex, individuals must have the technical knowledge to operate these devices.

2.2 Mobile learning

Mobile learning is depicted as a form of learning using mobile devices such as laptops and other handheld and portable devices(Alsaadat, 2017; Kumar & Mohite, 2018). Cromptona and Burke (2018) add that M-learning can allow individuals to "learn through a wide range of contexts, via social media and interaction, using personal portable devices or commonly known as mobile devices". These devices allow the user to navigate through various learning materials (Pramana, 2018). Hamidi and Chavoshi (2018) argue that M-learning is a critical component for learning in a formal environment, as it presents individuals a way to learn and collaborate with the aid and support of technology. Ferial, Wolfgang, and Kim (2016) expand that m-learning is not just a technologically distributed learning approach. However, it also refers to the mobility of the individual, students or learner and their engagement in learning activities without physical location limitation (Briz-Ponce, Pereira, Carvalho, Juanes-Méndez, & García-Peñalvo, 2017). Miller and Cuevas (2017) suggest that mobile devices can be useful in a learning environment as it allows an increase in engagement and collaboration between students.

Dunleavy et al. (2019) researched the effectiveness of m-learning and concluded that m-learning is an innovative and novel strategy to implement. They stated that m-learning is equal to, if not higher than, and more effective than, the traditional learning approach for skill and knowledge development and improvement. Similarly, Kim and Park (2019) researched the effects of m-learning in nursing education and concluded that using mobile devices showed positive change and therefore, a positive impact on the students' knowledge, skill level, as well as confidence in academic performance. Also, m-learning can be a new approach or a supportive method, which can influence how individuals learn within a formal learning setting. M-learning enables students to study and to learn by way of sharing ideas, which is a form of collaboration (Castillo-Manzano, Castro-Nuño, López-Valpuesta, Sanz-Díaz, & Yñiguez, 2017).

2.3 Mobile devices/technologies

Göksu and Atici (2013) commented on mobile devices in which all mobile device are classified as (smartphone) phones, tablets/iPads and notebooks (laptops).

These mobile devices allow individuals to work on documents, using cloud technology to store and synchronise all information to all devices. Using WIFI and/or Internet data to perform quick and fast information checks, access academic databases, navigate through different information, appoint meetings and many essential activities and tasks that are related to ones' learning journey (Fojtik, 2017; Onaolapo & Oyewole, 2018; Samaha & Hawi, 2016). The frequent use of these devices, according to Briz-Ponce et al. (2017), is that mobile devices are used regularly for learning, entertainment, as well as communication and collaboration (Ramadiani, Azainil, Haryaka, Agus, & Kridalaksana, 2017).

O'Connor and Andrews (2018) explored the possibility of mobile devices, more specifically phones and the numerous features the phone presents via its applications. They found the features and applications in these devices to be supportive tools for nursing and health students. To O'Connor and Andrews understanding of their results, many of the students used the features of the phones and the apps to support their learning, where large quantities of students admitted that using mobile devices was useful. For example, having fast and better access to materials. Mobile devices offer different functions that can be used when learning. Such features include, but are not restricted to, communication types such as texting (short message) multi-media messaging, GPS location functions, video and visual capturing, connection functions, WIFI, Bluetooth and many other features (Balfagih, 2017).

Onaolapo and Oyewole (2018), expressed that mobile technologies allow mobile devices to operate, and features such as connecting two devices wirelessly, or connection to the Internet via WIFI or mobile data, keep information stored on the mobile devices synchronised using cloud computing. Another form of technology that can cause a change is the AR/VR, which is short for augmented reality/virtual reality. AR/VR has the potential to increase proficiency and efficacy of m-learning, as well as being common within the realms of education and learning (Göksu & Atici, 2013). Having all these capabilities available offers individuals new ways to learn with different avenues for support and assistance (Callum, Day, Skelton, & Verhaart, 2017). There are more elements of technology for mobile devices. However, the point is that mobile technologies are critical components for the establishment of m-learning or learning with mobile devices (Kuboye, Oloja, & Obolo, 2014).

2.4 Learning with mobile devices

Many people have mobile devices in their possession. These devices are used in many situations, such as socialising, commuting, business situations, as well as learning situations.

These devices are useful and helpful to individuals' learning. The tasks that can be performed on these devices can support individuals in their academic pursuits. Since mobile technologies are always developing and improving, mobile devices have the potential to offer a wider range of learning opportunities, styles, resources. However, there are disadvantages associated with these devices. (Damyanov & Tsankov, 2018).

2.4.1 Formal learning environment

There are two settings of learning: formal learning and informal learning. Mobile learning is associated with both formal and informal settings. Formal learning refers to students or learners interacting and engaging with content and material created by tutors or education organisations, which are used in a structured module with a certificate of some sort upon its completion (Gikas & Grant, 2013). Informal learning refers to results via daily tasks or family and leisure activities. Furthermore, informal learning is often identified as an unstructured, unidentifiable and unintentional to the learner (Jubas, 2010).

2.4.2 Gender and devices for learning purposes

Brown (2018) studied the use of mobile devices for language learning with a focus on gender factors. In terms of learning languages, the researcher expected more females to study languages than males due to their desire to converse. However, when technology and mobile devices are used, the researcher surmised that there are no significant differences between the genders. Davison and Argyriou (2016) researched technology adoption/utilisation and preferences concerning gender. Their findings imply that the adoption of technology for mobile learning is consistent across genders and that there is no gender gap. Furthermore, they reported that laptops were the most preferred mobile device for mobile learning, with tablets being more favourable towards males than females, as well as phones.

There are also similar results that the perception of the use of mobile tools for learning purposes are not different between the genders (Snell & Snell-Siddle, 2013). Adedoja and Morakinyo (2016) did a study on gender influence on undergraduates' acceptance of mobile learning and implies that when using mobile devices, there is no variation or contrast between males and females. They also stated that females adopted and utilised mobile devices for mobile learning due to the accessibility to resources and content at any time of day.

2.4.3 Mobile devices: useful, helpful

Individuals tend to own and use their mobile devices for many tasks and other things in their daily lives. With the developments happening in mobile technology and apps, the learning

opportunity advances and extends to simulations, voice recording, games, and social media (Damyanov & Tsankov, 2018). The use of mobile devices for learning reasons and purposes are increasing (Pimmer, Mateescu, & Gröhbiel, 2016).

Eppard, Nasser, and Reddy (2016) explore learning with mobiles to find applications that can be applied when learning English; such apps include SMS (SMS texting, to learn and increase lexical knowledge), and MP3 for audio files to help with pronunciation. In a similar context, text messaging, calculators and dictionaries were the most common features or apps used in a formal learning setting (Taleb & Sohrabi, 2012). Additionally, Zydney and Warner (2016) state that in science-based learning, students can be aided by apps with GPS- location capabilities, visual and audio tools, as well as information sharing applications.

With the large number of features that mobile devices have, as well as the full range of applications available to the devices, the use of its technologies for learning and education purposes offer individuals an opportunity to redesign and reshape how they learn (Heflin, Shewmaker, & Nguyenne, 2017).

Hamdani (2013) discovered how useful and valuable devices are as tools for learning within the formal learning environment. One of the areas that were used by students was social media and its full platform as some students were using Facebook, email, and twitter. Social media is often used to collaborate with other students. Vázquez-Cano (2014) has suggestions, much like Hamdani, in the sense that mobile devices can provide individuals assistance by connecting users to the Internet, to access online information, as well as enabling individuals to interact with each other. Some activities regularly performed by students when using mobile devices within the classroom were searching for information, obtaining books and references, and searching dictionaries.

Furthermore, the study also revealed that the devices did affect individuals as it assisted them in selecting the right information and helping them with memorisation. Al-Hunaiyyan, Alhajri, and Al-Sharhan (2018) researched whether mobile devices are useful in the classroom and if they were enough to support and assist individuals. They concluded that using mobile devices in the classroom is helpful to students and instrumental to their learning. Furthermore, their study also indicated that social media platforms (YouTube, Facebook, Instagram) were often favourable with individuals when learning, as it enables them to discuss study topics, interact with other online users, and to share ideas and information.

2.4.4 **Potential use of mobile devices**

Mobile devices are viewed as well-known, favourite tools used in daily tasks. Mobile devices are also considered as well-known, popular tools used in learning activities, which increases the potential of these devices for learning purposes. The growth of popularity of these devices is elevating learning and education to new heights, offering new learning opportunities, widening the scope of learning in a formal setting (Al-Zahrani, 2016). Fojtik (2015) also supported that mobile devices are gaining popularity as mobile devices sales surpassed desktop computers. He also conveyed that the developments of mobile technologies are not just advantages from a technological point of view but also an educational point of view, as it will provide more exceptional options to learners and students. Therefore, mobile devices and technologies are affecting the way in which individuals learn (Grimus, 2014)

At present, all handheld, portable and mobile devices permit the user to work on all types and kinds of documents, create and alter all forms of data With connection technologies, all forms of data can be synchronised to various devices and access such data from any device, located anywhere (Fojtik, 2017). Mtega, Bernard, Msungu, and Sanare (2012) implies that current phones can aid individuals to learn as phones, and other devices, can access the web, course content, share it, communicate and collaborate with others, and they allow the ability to store information. File types such as mp3, pdf, docx and many others can be stored on these devices which widens the learning and collaborative opportunities for users and learners. Furthermore, individuals can check their schedules, tasks, appointments, work with multimedia data from anywhere, any time on any device (Fojtik, 2017). Haßler et al. (2016) reported on the features mobile devices have, more specifically towards tablets having features such as cameras, accelerometers, microphones, having access to tools such as references and dictionaries in one single device allowing a diversity of learning mediums.

Customisation: Mobile devices allow individuals to adjust aspects of the interface appearance such as text size, font and colour as well as altering the screen modes (landscape, portrait), which gives individuals opportunities to personalise the appearance and use of their device. Furthermore, should there be a need, a more personal learning environment can be created with these mobile devices, which can support the more extensive learning approaches (Hashim, Tan, & Rashid, 2015).

Availability and portability: These devices have the ability to create an immersive learning experience and can create an environment that is not accessible due to limitations on finances,

practicality, and/or geographical boundaries. Furthermore, these devices are made for mobility, which is easy for individuals to hold and carry (Dundar & Akcayir 2012). Due to this portability, individuals can learn anywhere, at any time or place.

Virtual Reality and Augmented Reality: Bacca, Baldiris, Fabregat, and Graf (2014) studied AR trends and summarised that AR is used for learning within the following domains: Health and the sciences, arts, as well as the education domain itself. Using AR can be useful towards individuals learning as it can increase student interaction and engagement, potentially creating better learning performance. With the main advantage being interaction and collaboration. FitzGerald et al. (2013) argued that using VR for formal education can have a positive influence over students, encouraging engagement and learning motivation. A pilot test was conducted using VR/AR for learning human anatomy, and the results revealed that students were satisfied with the learning, which in turn impacted their learning process in a positive manner (Jamali, Shiratuddin, Wong, & Oskam, 2015).

Wu et al. (2012) indicated that developments in communication and WIFI technologies have resulted in mobile devices being more available and more versatile. With newer and more enhanced features and technologies added to these devices such as WIFI, audio, music, visual recorders, productivity applications, sensors and so on and so forth, these innovations significantly increase the potential use of devices for learning purposes offering a broader range of possibilities.

Using mobile devices, be it a phone, a tablet or a laptop can create a multitude of learning opportunities. Taleb and Sohrabi (2012, p. 1104) list the different aspects of mobile devices that can increase the potential use for enhancing the learning process for students. The prominent features of mobile devices that contribute to this are:

- calculator use
- educational SMS
- recording of learning content
- use of education applications
- use of the Internet for learning needs
- capturing images of learning materials
- listing to learning recordings
- sending and receiving emails.

Furthermore, Table 3 classifies and categorises technologies and applications associated with mobile devices that can be utilised by individuals while learning (Johnston, 2016, p. 27).

Table 3.

Technology category and example of apps

Category	**Examples of applications and tools**
Course content and survey tools	Moodle, Survey Monkey
Podcasts and streaming	Camtasia
Social media	Facebook, Twitter
Document sharing	Google suit, Office 365
Shared communication	Skype, Zoom
Video sharing and streaming	Youtube, Twitch
Virtual worlds and gaming	VR and AR

2.4.5 **Difficulties: learning with mobile devices**

Many times, mobile devices can be easy to operate and can be useful for learning and education purposes (Damyanov & Tsankov, 2018). Mobile devices and its technologies should not hinder nor add more confusion to learning, but they should complement the learning experience, enabling the individuals to learn while using their tools. Things such as multitasking, the technical elements, the ability to use mobile devices can cause a negative effect on the individuals. As advancements are made in technology, advancements in costs for those technologies can also occur. This can often negatively impact on learners as the cost of appropriate devices increases. As the access to information is good, there can be challenges with the information as it may be an uncredited source or far too much information. If an individual or learner can manage the bountiful sources of information, that too can create stress and hinder the learning process even further (Sana, Weston, & Cepeda, 2013).

A common aspect of mobile devices used in a formal setting is the engagement of multitasking mobile devices (Junco, 2012). Junco and Cotten (2012) stated that multitasking is when an individual is concurrently performing more than two tasks and activities, switching from one task to another, to another. Furthermore, should multitasking be performed with more than one medium, that is known as media multitasking (Judd, 2014, p. 194). Multitasking places stress and demands on the mental load of the individual, and

therefore, degrades the academic performance of said individual resulting in a lower score than those who do not multitask with their devices (Sana et al., 2013).

Pedro et al. (2018) describes a scenario (based on real events) where a lecturer supports the usage of technology in a formal learning environment, however, said lecturer request all students to set aside their devices (laptops, phones and other mobile devices) during his lessons, because he noticed a rise in the distraction levels when devices were used in the lesson. However, such ideas are not new, as more than a decade ago researchers reported such concern for laptops as a distraction and interruptions as the visual nature of laptops as well as messages, posts, notifications and the various features laptops offer could be distracting.

2.5 Literature review conclusion

Mobile devices are ever-present in the lives of people and offer a form of support to people. These mobile devices are defined as portable electronic devices, which are commonly described as laptops, tablets, phones and PDAs.

These devices are embedded with technologies that enable these devices to function in different capacities. Such technologies include, but are not limited to, touch screens, sensors and detectors, networking technologies: WIFI, 3G,4G, in-built camera and microphones from audio/visual capturing, and a plethora of applications. There is a broader range of capabilities or services associated with mobile devices, and these capabilities or services can be described as, voice capture, short message services (SMS), location-based services (GPS), applications and other services.

There is a learning approach, known as mobile learning. There are various descriptions of mobile learning. However, the core of this learning approach is to use mobile devices to accomplish the learning goals of individuals, while maintaining the mobility of the learning and the learning that causes an “anywhere, any place, and any time” style. Mobile learning can be utilised formally or informally. However, the literature addressed mobile learning in a formal environment. Formal learning is described as a learning module that has been structured and delivered by education organisations.

The services and technologies enable devices to be used for learning purposes, for example: using the SMS function to learn grammar and spelling for learning, access course content, record lectures and class with the voice capture, installing third-party applications that can

further the services and capabilities for a mobile device. Therefore, the services make devices useful and helpful for individuals as they learn in a formal setting.

As the technologies develop and improve, the potential of using mobile devices in a learning context increase, offering a diverse range of learning. Mobile devices are heavily customisable as it permits individuals to alter the functions of the devices entirely, such altercations include, text, font and size of text, its accessibility to materials at any time, using VR and AR to immerse individuals in a learning experience, or the creation of a virtual learning environment.

However, there are things to be concerned about when mobile devices are used. The quality of information and applications for learning purposes may not be of high and credible quality. Also, the amount of information that can be accessed via mobile devices is a lot. Mobile devices offer multi-tasking capabilities, where an individual performs more than two tasks at the same time. Multi-tasking has been associated as a distraction and has been known to disrupt the attention of people.

There were also indications that there was no difference between gender when mobile devices were used for learning or non-learning purposes, however, it seems that laptops were the most preferred mobile device for mobile learning, with tablets being more favourable towards males than females as well as phones.

A protocol was used for collecting sourcing and literature. Using the WINTEC One search to find and retrieve articles. The reason for the protocol was to review articles and other sources on mobile learning, mobile devices and its use for formal learning. To find those articles the following keywords were used (m-learning **or** mobile learning **or** mobile device learning) **OR** (mobile technology in education **or** Mobile and blended learning) **AND** (learning **or** education **or** studying **or** academic). The number of potential articles resulted in more than 30,000 in the search, to filter those results, the author used the criteria proposed in the protocol, 172 articles were approved, and 68 articles were used.

3 Research Methodology

The research methodology is the study of methods or procedures used to answer or find the results of the research question or topic (Surbhi, 2018). The research methodology is the science of understanding how research should be undertaken and performed thoroughly and systematically as research methodology is associated with rigorous analysis and examination of utilised methods, to guarantee that conclusions and final findings are acceptable.

3.1 Research objectives

The study aims to discover the effects mobile devices have on people as they learn. By carefully determining what mobile devices and functions are used by individuals for learning and study purposes the following objectives can be addressed:

- The usefulness of mobile devices
- The reasons why mobile apps and devices are used
- The capabilities mobile devices provide that make learning more accessible
- The kinds of apps that are used or can be used for learning
- The supportive role the devices have when individuals are learning
- How these mobile devices are used
- Finding out if mobile devices provide individuals with various ways of learning
- The most common devices selected to be used for learning.

3.2 Research question

The idea of mobile devices used for learning purposes was inspired by conversing with gaming enthusiasts, technology enthusiasts, as well as students regarding the influence of smartphones and other mobile devices on people. Additionally, one could not help but meditate or contemplate on the notion of mobile devices used by individuals as they learn in a formal learning environment. Many students, gamers and technology fans admitted to using a single device or multiple mobile devices while studying as well as conveying their opinions on the elements and features the different devices present, which influence the perceived usefulness of the devices and how easy some devices are to use for specific academic activities than others.

Therefore, considering the conversation as well as the objectives of the research, the main research question becomes: What elements can affect people learning when using mobile devices?

The main research question can be broken into the sub-questions.

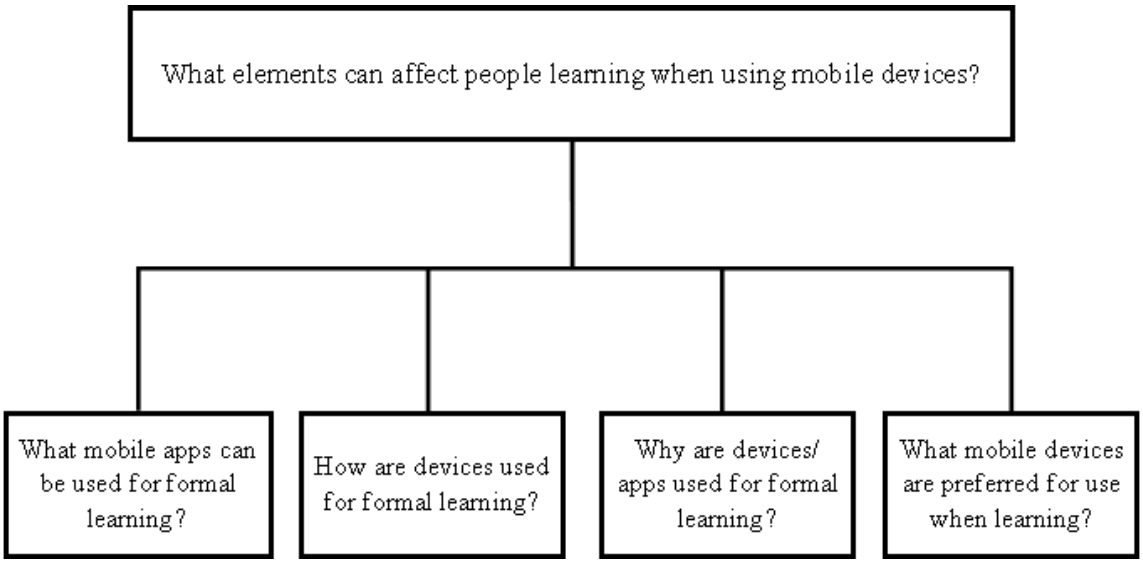


Figure 3 Sub-questions for the research

Figure 3 addresses several aspects of the leading research question, which will aid in answering the question. There are four questions derived from the main question.

1. What mobile apps can be used for learning?
2. How are devices used for learning?
3. Why are apps/devices used for learning?
4. What mobile devices are preferred for use when learning?

3.3 The hypotheses

Using the sub-questions above as the foundation and taking into account the objectives of the research, four hypotheses were developed.

- H1: Mobile devices are useful when learning in a formal environment.
- H2: Mobile devices make learning less challenging in a formal setting.
- H3: Mobile devices support learning in a formal environment.
- H4: Mobile devices do offer a wide range of learning approaches in a formal environment.

3.4 Theoretical model: Technology Acceptance Model (TAM)

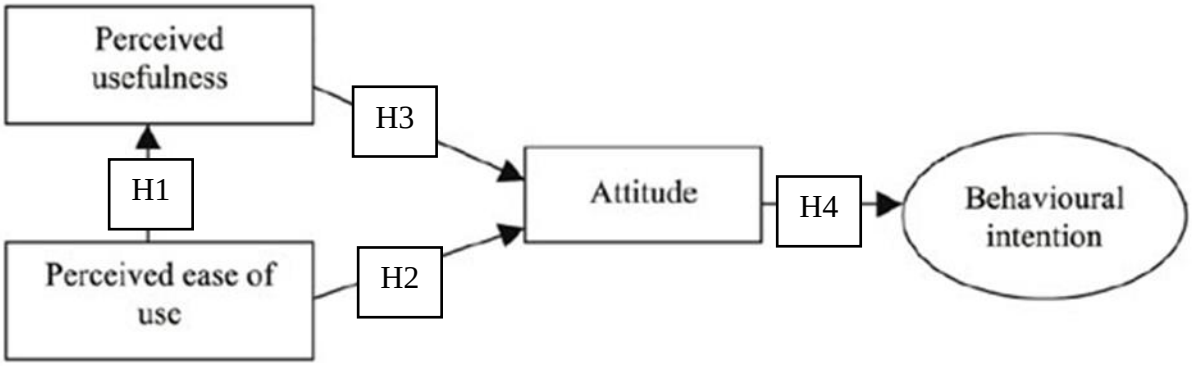


Figure 4 Technology acceptance model (Source: Davis et al., (1989), Venkatesh et al. (2003))

As presented in Figure 4, the TAM model, Technology Acceptance Model, describes and explains the relationship between technology and individuals, and how technology and its' many aspects are presented/seen and used by individuals (Fathema, Shannon, & Ross, 2015). The TAM model illustrates how technology and all of its' elements and aspects are accepted and used by individuals.

Factor 1, perceived usefulness: usefulness is an indication that technology is helpful and useful for completing tasks and activities. Venkatesh, Morris, Davis, and Davis (2003) implies that the perceived usefulness addresses similar aspects as the performance expectancy factor from the UTAUT model or outcome expectations from the SCT model. Perceived usefulness in the context of learning with mobile devices posits that individuals will see mobile devices as useful and helpful because they have the capability to perform learning tasks more effectively (Pramana, 2018). Furthermore, per Figure 4, the perceived usefulness is seen as a determinant of the attitude, which influences the behavioural intention to accept mobile devices and thus it will show that individuals will accept mobile devices if they see their devices as useful. Therefore, this factor is imperative to describe the adoption of devices.

Factor 2, perceived ease of use: relates to the use of technology with little to no stress. Venkatesh et al. (2003) explain that the perceived ease of use share similarities with the UTAUT model effort expectancy. Regarding mobile devices, perceived ease of use suggests that the use of devices are comfortable and not complicated. As described by Fathema et al. (2015), perceived ease of use is more or less the level to which people think that using technology would exempt them from struggle and effort. Per Figure 4, the perceived ease of use is seen as a determinant of the attitude, which affects the behavioural intention to adopt

devices. Furthermore, perceived ease of use is also seen as a determinant of the perceived usefulness, which will affect the attitude that will influence the behavioural intention to accept mobile devices.

Both the factors verify the attitude of individuals towards the technology, which in turn influence, the actual acceptance of aid technology.

As the author is researching into the usefulness of mobile devices within a learning context and the effects mobile devices have, which in turn influence the acceptance of such devices while learning. The author believes that the TAM model reflects the explanation of mobile devices being received by individuals while learning within a formal context.

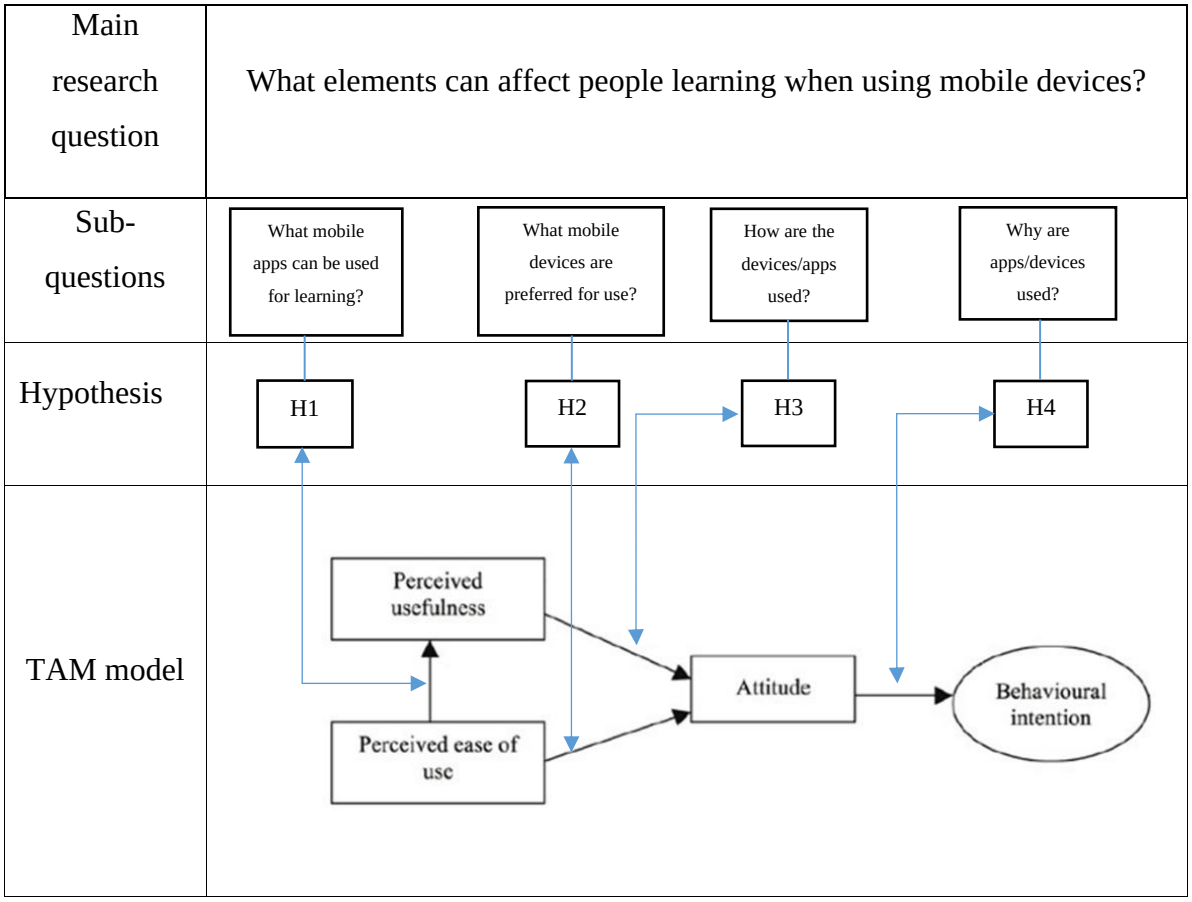


Figure 5. Research question, hypothesis and the TAM model

The objectives of the research are listed; the main research question is developed., the main research question is divided into four aspects that can aid in answering the main question; four hypotheses were created. Figure 5 depicts how everything is linked to the theoretical model. The following describes how the the sub-questions and the hypotheses are linked.

Sub-question 1: What mobile apps can be used for learning?

Hypothesis 1: Mobile devices are useful when learning in a formal environment.

The sub-question is to identify apps (be it in-built apps or third-party apps) used for learning. If apps are identified, and these apps are available on mobile devices, then the idea is that devices with used apps for learning are useful devices.

Sub-question 2: What mobile devices are preferred for use?

Hypothesis 2: Mobile devices make learning less challenging in a formal setting.

Mobile devices may have the potential to lessen stress when learning as different devices can help people in different ways and so the aim of sub-question 2 is to discover what device(s) is mostly used or preferred when individuals are learning. Therefore, the author hypothesized that preferred mobile devices make learning less challenging.

Sub-question 3: How are devices/apps used?

Hypothesis 3: Mobile devices support learning in a formal environment.

The aim of sub-question 3, is to understand how individuals use their devices in the context of learning as mobile devices are equipped with various technologies, apps and other features that may enhance and peoples learning. By understanding how individuals utilised their devices and apps for learning, the author hypothesized that mobile devices/apps could support learning.

Sub-question 4: Why are apps/devices used?

Hypothesis 4: Mobile devices do offer a wide range of learning approaches in a formal environment.

Sub-question 4, is about finding out the reason(s) on using devices/apps for learning, the reasons on how devices are used, what devices are preferred and reasons behind why such devices/apps are used. By finding out the reason why devices and apps are used, the author hypothesized that mobile devices offer a broader range of learning approaches.

3.5 World views

A world view (also described as a philosophical worldview or paradigm) suggests a simple and basic set of ideologies and beliefs "that guide actions" (Petersen & Gencel, 2013). Petersen and Gencel also stated that the worldview of a researcher affects the selection of research methods as part of the methodology.

There are four categories when addressing worldviews; post-positivism, constructivism, transformative and pragmatism. Table 4 presents the primary characteristics and elements related to each of the worldviews (Creswell, 2013).

Table 4.

Characteristics of four worldviews

Post-positivism	Constructivism
• Determination • Reduction • Empirical observation and measurements • Theory	• Understanding • Multiple participant meaning • Social and historical constructs • Theory generation
Transformative	**Pragmatism**
• Political • Power and justice • Collaborative • Changing	• Real-world application • Pluralistic • Consequences • Problem-centre

Note. Adopted from *Research design: Qualitative, quantitative, and mix methods approaches* (p 36), by John W Creswell, 2014, Thousand Oaks, California. SAGE Publications.

Per Petersen and Gencel (2013) post-positivism refers to an objective reality that exists 'out there' in the world. They hold a deterministic philosophy; that is, based on careful observations and measurements, they try to make an inference to a general truth.

Post-positivism implies that all forms of knowledge and understanding are to be founded and based on a proposition reached by process of inference. Researchers with this worldview often used methods such as control experiments, survey research, as well as case studies in their works (Easterbrook, Singer, Storey, & Damian, 2008).

Since the research is deductive research and hypotheses are tested, there are statistical analyses involved which attempt to discover links and trends in the data. Furthermore, surveys or online surveys are the favourable choices for data collection, which fits in the post-

positivism world view. With that in mind, post-positivism is the worldview choice of this author.

3.6 Research Design

Research is described as a process to understanding, or to further knowledge about a specific topic, problem/issue or interest (Ismail, 2014). The multiplicity in results and outcomes of research entails and needs a diverse and dissimilar research method for the different questions of the research. Additionally, the research communities have proposed various methodologies to offer researchers and other experts with techniques needed to meet the diverse nature of research (Ismail, 2014).

The art of research is a form of steps to be used for gathering and analysing information to enhance the researchers understanding of a specified topic. In a basic form, research entails three steps:

- Ponder on a question
- Collect information to answer the questions
- Using the information to present an answer or solution to the question (Creswell, 2012).

Let it be known that the process of research should be something familiar. When people solve day-to-day problems or something that has piqued their interest if they continue to pursue these ideas, they will begin to engage in the process of research. An individual will often start with a question, go and gather information to formulate a solution or to answer their question and come up with a conclusion. Though there are other steps to be concerned with, the three steps as pointed above is the foundation framework for researching, and as a researcher, these three steps are easily recognisable as primary core steps. As researchers examine academic articles, technical reports and other published papers, the primary steps will be present in the papers.

Think of a question, find information and then answer the question are the core steps for research (Creswell, 2012). However, these core steps can be expanded upon, which creates a six-step research process that is widely used and is common within the research realm,

1. Identify a research topic
2. Find and review the literature and other sources

3. Specify the aim or purpose of the research
4. Gather information
5. Analyse the information
6. Report the research.

Conducting research is not only following the primary steps of research, but there is also the design to consider. The research design consists of quantitative and qualitative research. Based on the research topic or interests that derive from the research topic as well as the proposed question to address the topic (with literature review, which justifies its significance), the author will use both quantitative and qualitative data and analyses. The topic, question and literature review assists the author to select an appropriate design; qualitative or quantitative (Creswell, 2012). Quantitative research design was selected for this research.

3.6.1 Characteristics: Quantitative approach

The primary and crucial characteristics of quantitative research are as follows Creswell (2012),

- Define and describe a research problem or idea by way of explanation of trends or needs to find understanding and describe a relationship between variables
- Giving a vital part for the literature by implying and proposing the research question to be asked as well as defending the research ideas
- Developing specific, measurable, and observable research questions and hypotheses,
- Gathering numeric data from large population utilising tools and instruments with questions and answers
- Analysing and exploring trends, needs, or finding relationships with variables using statistical analysis, interpret results as well as discussing them with the hypothesis and past research
- Compiling everything to a research report and taking an objective approach.

3.6.2 Quantitative research design: Survey design

Research survey design is a design that researchers select to administer a survey questionnaire to a sample size of a population to explain and illustrate opinions, ideas and characteristics. With this design the researcher gathers and collects quantitative, numbered information and data, with the use of survey questions (example: online survey, posted survey), interviews

(one-to-one interviews or one-to-many); data is then statistically analysed to identify and display trends that were derived from the survey response, which is then used to answer the research question(s) and address the research hypothesis/hypotheses (Creswell, 2012).

Various forms of surveys can be administered, such as paper-based or mailed surveys, interview (one-to-one or one-to-many) and online surveys. The focus of this research is on the use of the web-based survey approach with an online survey. Web-based or online surveys can collect data and information rapidly, using instruments such as SurveyMonkey or other software. The researcher can apply and employ tested survey designs, oppose to creating or designing the survey. Furthermore, as many individuals have access to the Internet and are registered members to numerous social media platforms, the researcher can create a link to the survey and make the survey available to the population who can engage with the survey at their leisure.

However, the negative side that the researcher needs to keep in mind is that online surveys are associated with a low response rate. According to Creswell (2012), technological problems, security concerns, non-random sampling often contribute to the low-rate or response via an online survey. Creswell also stated that online surveys could be biased to technologically literate individuals only.

3.7 Research Method

Figure 6 is a chart that depicts the research process employed in this research. As stated, this is quantitative research that involves a quantitative research design; as such, the survey design was selected. There are three primary action items in this process: sampling, data collection and analysis. In sampling, the author identified and selected a population, based on the population, the sample size was calculated using an online sample size calculator, then a sampling method was chosen.

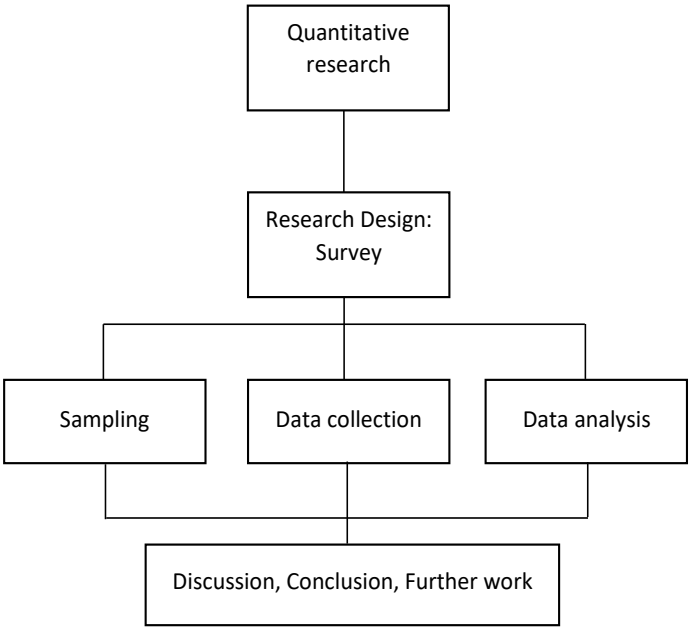


Figure 6. The research process

In the data collection phase of this process, the author investigated online survey tools and instruments and determined the most suitable tool to create and administer the survey with ease.

The analysis involves the breaking down of the data into groups to find answers to the research question. Quantitative and qualitative analysis is applied. Quantitative is using descriptive statistics to summarise the data using measures such as frequencies and percentages. Qualitative is using a narrative approach by creating stories, participant sub-group stories.

Based on the data analysis, the author discusses the trends, themes and notions that are discovered during the analysis to draw a conclusion.

3.7.1 Population

The basis of the population is from students of all levels of education studying Information Technology from all tertiary education providers nationwide in 2017, which is 13,515. So, the population selected is 13,515 (Education Courts, 2018). There is an online calculator available at surveysystems.com that can calculate the sample size based on the population to which the author used.

3.7.2 Sampling Method

The sampling method chosen for this research is the convenience sampling method.

Convenience sampling, as the name implies, is a type of non-probability method that depends on collecting and gathering data from the population at the convenience and availability of individuals to participate in the research. Social media surveys are good examples of convenience sampling methods. There are benefits of convenience sampling: this is simple and easy to apply; data gathering can be facilitated in a limited amount of time (Saunders, Lewis, & Thornhill, 2012).

As Facebook is known to be the popular social media platform and that a wide range of people are active users, the author decided that Facebook is ideal. Facebook is ideal because invites can be sent to friends as well as sending request to friends of friends to share and repost the survey link for other people and invite them to participate if they wish.

3.7.3 Sample Size

The sample size is the number of completed responses the researcher receives. The reason why it is known as a sample is due to the fact that it signifies a portion of the target population whose response the researcher is interested in (Survey Monkey, 2019). The sample size needed to achieve statistical significance is 575, with a confidence interval of 4 and a 95% confidence level.

3.7.4 Data gathering method

The data gathering for the research project was performed using a self-directed online survey administered via Facebook. Friends of the author who are current and former WINTEC students as well as other associates from Waikato University were sent a request to participate in the online survey as well as inviting their associates to do the same. Furthermore, when the author had exhausted his options, the supervisors aided the author by sending requests to

other lecturers and educators of other tertiary providers to make the survey available to their students.

. There are 13 items in the survey, covering the following areas:

- Demographic results, age and gender
- Regular use for study and leisure
- Mobile devices support and improve learning productivity
- Mobile apps used for learning
- Performing tasks using mobile devices
- Mobile devices (laptops, smartphones, tablets)

Each item in the survey is open-ended for participants to voice other ideas and concerns. However, considering this, the time to complete the survey should be no less than 5 minutes. All participants were made aware before starting the survey that all responses will be anonymous, and all information will be secure with the highest data protection tools available for students and researchers to use.

The timeframe for this survey was one month, as to give time for participants to respond and attempt statistical significance. Due to not accomplishing the target number of answers, the author did not achieve statistical significance and therefore, will use descriptive analysis.

3.7.5 Description and explanation of question items

The following identifies and explains the questions in the survey as well as the structure of the questions.

Q1. To which gender identity do you identify?

- Female
- Male
- Other

The question aims to identify with which gender participants associate. Question 1 is a multi-choice single answer question, where the participant can only select one of the answer choices: female, male or other.

Q2 Please specify your age?

- 18-23

- 24-28
- 29-33
- 34-39
- 40+

This question aims to find what age best describes participants. The question is a multi-choice single-answer question where the participants select one of the answer choices that best describes them. The answer choices are 18-23, 24-28,29-33,34-39 and 40+. People under 17 years of age were not considered because they are too young to participate in the research.

Q3 How frequent are mobile devices (e.g. phones, laptops, tablet) used for formal studying?

- Very frequent
- Frequently
- Sometimes
- Not that much
- Not at all
- ➢ Any other comments (please specify)

The purpose of question 3 is to identify the frequent use of mobile devices by participants in correlation to formal studying or learning.

This is a multi-choice single answer question using a 5-point Likert scale for answer choices available to the participants. Additionally, there is a comment box for participants to further explain their answer or to offer their opinion on the matter of the question.

Q4 How frequent are mobile devices (e.g. phones, laptops, tablets) used for leisure?

- Very frequent
- Frequently
- Sometimes
- Not that much
- Not at all
- ➢ Any other comments (please specify)

The purpose of question 4 is similar to question 3. However, the differences identify the frequent use of mobile devices for leisure purposes such as games, social media, or listening to music.

This is a multi-choice single answer question using a 5-point Likert scale for answer choices available to the participants. Additionally, there is a comment box for participants to further explain their answer or to offer their opinion on the matter of the question.

Q5 In your experience, devices (e.g. phones, laptops, tablets) can be used to support formal learning?

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagrees
- ➢ Any other comments (please specify)

The goal of question 5 is to find out via participants experience with devices if, in their opinion, devices can provide support when learning in a formal environment.

This is a multi-choice single answer question using a 5-point Likert scale for answer choices available to the participants. Additionally, there is a comment box for participants to further explain their answer or to offer their opinion on the matter of the question.

Q6 In your experience, devices (e.g. phones, laptops, tablets) can improve formal learning productivity?

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagrees
- ➢ Any other comments (please specify)

Question 6 addresses the experience of participants with their devices and questions if using their devices can improve the work rate concerning studying or formal learning.

This is a multi-choice single answer question using a 5-point Likert scale for answer choices available to the participants. Additionally, there is a comment box for participants to further explain their answer or to offer their opinion on the matter of the question.

Q7 In your experience, what types of apps can be used for formal studying? (please select all that apply)

- Tools
- Games
- Business
- Education
- Photography
- Social media
- Music and audio
- Health and fitness
- Books and references
- Video players and editors
- ➢ Any other comments (please specify)

Question 7 is to identify what form of application(s) can aid individuals as they study according to the experience and opinion of participants.

This is a multi-choice, multi- answer question, where participants can select all choices that apply to the question. Additionally, there is a comment box for participants to further explain their answer or to offer their opinion on the matter of the question.

Q8 In your experience, a smartphone is used for formal learning.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagrees
- ➢ Any other comments (please specify)

The question verifies with the participants that smartphones are or can be used for formal learning purposes.

This is a multi-choice single answer question using a 5-point Likert scale for answer choices available to the participants. Additionally, there is a comment box for participants to further explain their answer or to offer their opinion on the matter of the question.

Q9 in your experience, using a smartphone can, (please select all that apply):

- Access academic information easier and faster
- Make note taking easier and faster
- Make report writing easier and faster
- Surf the Internet easier and faster
- ➢ Any other comments (please specify)

This question identifies what tasks or capabilities that participants agree with when using their smartphones for formal learning.

This is a multi-choice multi answer question. Additionally, there is a comment box for participants to further explain their answer or to offer their opinion on the matter of the question.

Q10 In your experience, a tablet is used for formal learning.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagrees
- ➢ Any other comments (please specify)

The question verifies with the participants that tablets are or can be used for learning purposes.

This is a multi-choice single answer question using a 5-point Likert scale for answer choices available to the participants. Additionally, there is a comment box for participants to further explain their answer or to offer their opinion on the matter of the question.

Q11 in your experience, using a tablet can (please select all that apply):

- Access academic information easier and faster
- Make note taking easier and faster
- Make report writing easier and faster
- Surf the Internet easier and faster
- ➢ Any other comments (please specify)

This question identifies what tasks or capabilities that participants agree with when using their tablet for formal learning.

This is a multi-choice multi answer question. Additionally, there is a comment box for participants to further explain their answer or to offer their opinion on the matter of the question.

Q12 In your experience, a laptop is used for formal learning.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagrees
- ➢ Any other comments (please specify)

The question verifies with the participants that laptops are or can be used for formal learning purposes.

This is a multi-choice single answer question using a 5-point Likert scale for answer choices available to the participants. Additionally, there is a comment box for participants to further explain their answer or to offer their opinion on the matter of the question.

Q13 In your experience, using a laptop can, (please select all that apply):

- Access academic information easier and faster
- Make note taking easier and faster
- Make report writing easier and faster
- Surf the Internet easier and faster
- ➢ Any other comments (please specify)

This question identifies what tasks or capabilities that participants agree with when using their laptops for formal learning.

This is a multi-choice multi answer question. Additionally, there is a comment box for participants to further explain their answer or to offer their opinion on the matter of the question.

3.8 Reliability

As reliability is concerned with consistency, two forms of question types were used in the survey, multi-answered and single answer. A five-point Likert scale was used for single answered questions. Consistency also applies to the wording of the questions. Therefore, while developing the survey questionnaire, the questions were checked by the supervisors to ensure that the questions were worded correctly and leave no room for misinterpretations. It was also examined by IT professionals to clarify if any technical terms or questions were phrased in a non-technical manner.

3.9 Validity

There are forms of validity that are associated with surveys such as content, internal and external validity. Saunders et al. (2012) stated that:

- Content validity refers to the ability to pose questions that relate and deal with the research topic or issue and ensuring that the key components or themes are not excluded. The author kept referring back to the research objectives, hypothesises and the literature review to ensure that the main themes and the research topic would be seen throughout the survey.
- Internal validity refers to whether a question can explain the outcome of the research topic. Due to the research topic, the author poses questions that identify aspects or factors that can determine the use of mobile devices while people are learning in a formal setting.
- External validity refers to the generalisation of questions, in other words making sure the questions are written in a way that the populace understands, as a researcher would not want to construct questions with terms that are foreign to its target audience. The author corresponded with IT professionals, his supervisor, as well as non-technical literate individuals to ensure that the survey was easy to understand.

To summarise, this section aims to understand the research process and the reason for the research. The research objectives have been identified; the development of the research question and the sub-questions were described. From the sub-questions, four hypotheses were created to compliment the questions posed. The Technology Acceptance Model (TAM Model) was selected based on the research topic.

Furthermore, a philosophical paradigm, also known as a world view, was discussed. An appropriate research design was chosen for this research, based on the design, a suitable research method was then selected. Finally, the survey items were explained, the type of questions and the aim of the questions within the survey were described.

4 Analysis

Analysis aims to examine and report findings on the research per the selected methodology for gathering data. The analysis is arranged and grouped in a meaningful manner. Two forms of analysis methods were applied for this research to find meaning for the collected data. The two forms employed for data analysis in this research are the quantitative (descriptive statistics) and qualitative (participant sub-grouped stories) methods.

Quantitative analysis refers to converting raw and unprocessed numbers and figures into significant data by employing critical and logical thinking, which may involve calculations of percentages, frequencies, and many other forms of calculation. Furthermore, quantitative analysis is correlated to discover data that will support or not support hypotheses that were developed earlier in the research (Creswell, 2012).

Qualitative analysis refers to non-numeric data such as interviews, notes and written materials, and video and images. These forms of data can be collated and depending on the type of data, can be thematically organised based on the different areas of sub-questions and/or hypotheses of the research (Creswell, 2012).

4.1 Quantitative results

The results of the online survey were analysed using descriptive statistical analysis. The survey questions are grouped according to the areas covered by the survey, as mentioned in section 3.7.4. The following lists the areas that the survey covers and the corresponding questions:

- Demographic results, age and gender: refer to Question 1 and 2
- Regular use for study and leisure: refers to Questions 3 and 4
- Mobile devices support and improve learning productivity: Questions 5 and 6
- Mobile apps used for learning: refers to Question 7
- Performing tasks using mobile devices: refers to Questions 9, 11 and 13
- Mobile devices (laptops, smartphones, tablets): refers to Questions 8, 10 and 12.

4.1.1 **Demographic results, age and gender**

Demographic results refer to the age and gender of participants, using descriptive statistics the author will find meaning and understanding in the data.

An analysis of Question 1

Table 5.

A brief summary of answers to Question 1

Q1. To which gender identity do you identify?		
Answer Choices	Responses	
Female	85.37%	35
Male	14.63%	6
Other	0.00%	0

Table 5 shows the total amount of participants divided by gender. For this survey, there were 41 in total, with 35 or 85.37% of participants identifying as female, and 6 or 14.63% of the participants identifying as male, with zero per cent of participants identifying themselves as other.

An analysis of Question 2

Table 6.

A brief summary of answers to Question 2

Q2. Please specify your age?		
Answer Choices	Responses	
18-23	0.00%	0
24-28	2.44%	1
29-33	12.20%	5
34-39	9.76%	4
40+	75.61%	31

Table 6 shows the age groups of participants. 2.44% (or one participant) was aged between 24-28 years of age. 12.20% (or 5 participants) were aged between 29-33. 9.76% (or 4 participants) were aged between 34-39. 75.61% (or 31 participants) were aged 40 years and over.

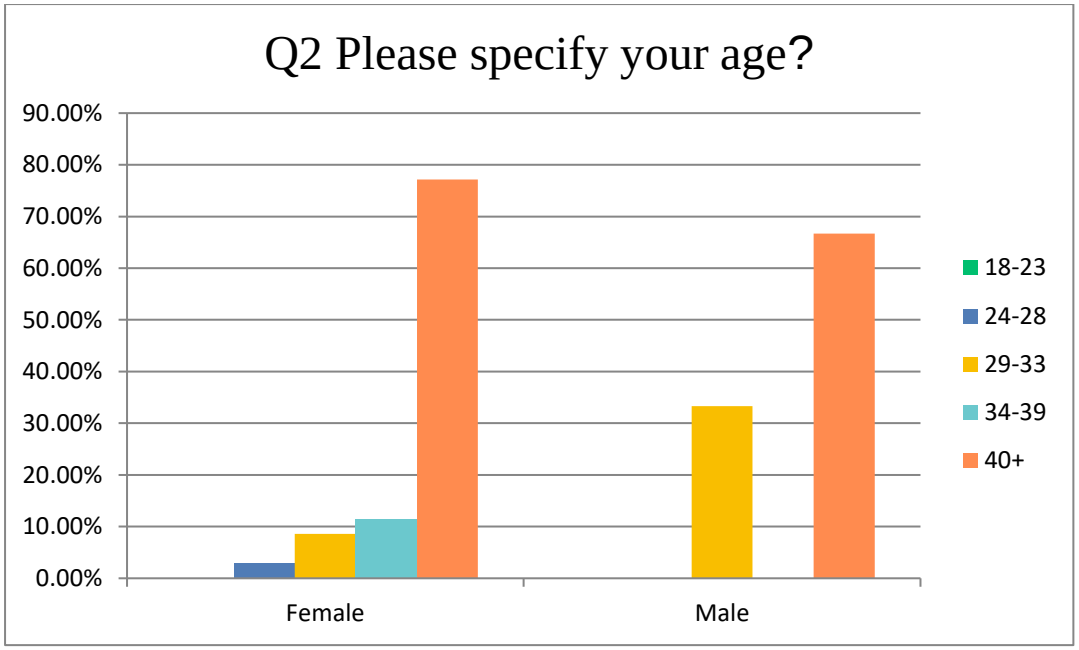


Figure 7. Graphical depiction of Question 2 by gender

Figure 7 gives a graphical representation of responses to question 2 by gender. The colours depict the different age groups selected by the participants, as indicated on the right side of the graph. With male participants this graph shows that they have indicated that their age range is from 29-40+. Looking at the female side of the graph indicates more of an age range than their male counterparts. As the graph shows, the age range is 24-40+.

To summarise an analysis was conducted on demographic information that was derived from Question1 and Question 2. The next section addresses the analysis of results from Question 3 and Question 4.

4.1.2 **Regular use of mobile devices**

The following tables depict the frequent use of mobile devices, as indicated by participants for formal learning and leisure purposes.

An analysis of Question 3

Table 7.

A brief summary of answers to Question 3

Q3. How frequently are mobile devices (e.g. phones, Laptop, Tablet) used for formal studying?		
Answer Choices	Responses	
Very frequently	34.15%	14
Frequently	36.59%	15
Sometimes	9.76%	4
Not that much	9.76%	4
Not at all	9.76%	4

Table 7 shows the responses for question 3. 34.15% (or 14 participants out of 41) indicated that mobile devices are used very frequently for formal learning, 36.59% (or 15 participants out of 41) pointed out that devices are used frequently. With 9.76% (or 4 participants out of 41) imply that their devices are sometimes used for formal studying, not used often for formal studying, and is not used at all for formal study purposes.

Table 8.

Answer to Question 3 grouped by gender

Q3. How frequently are mobile devices (e.g. phones, Laptop, Tablet) used for formal studying?									
	Very frequently		Frequently		Sometimes		Not that much		Not at all	
Female	34.29%	12	34.29%	12	11.43%	4	8.57%	3	11.43%	4
Male	33.33%	2	50.00%	3	0.00%	0	16.67%	1	0.00%	0

Table 8 shows responses to the question grouped by gender: female, male. 34.29% of female participants expressed that mobile devices are used very frequently for formal studying, with 33.33% of male participants also stating that their devices are used very often. 34.29% of female participants agree that devices are used frequently, with 50% of males showing that devices are frequently used for formal study. 11.43% of female participants claim that they

sometimes use their devices for formal study. 8.57% of female participants reveal that devices are not used as much for formal study, while 16.67% of male participants stated the same thing. 11.43% of female participants said that devices are not used at all for formal learning activities.

Table 9.

Answer to Question 3, grouped by female age groups

Q3. How frequently are mobile devices (e.g. phones, Laptop, Tablet) used for formal studying?										
Age groups	Very frequently		Frequently		Sometimes		Not that much		Not at all	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	**100.00%**	1	0.00%	0	0.00%	0	0.00%	0
29-33	**100.00%**	3	0.00%	0	0.00%	0	0.00%	0	0.00%	0
34-39	**50.00%**	2	**50.00%**	2	0.00%	0	0.00%	0	0.00%	0
40+	**25.93%**	7	**33.33%**	9	**14.81%**	4	**11.11%**	3	**14.81%**	4

Table 9 shows the level of use of mobile devices for study by females in different age groups. 100% of females aged 24-28 said that they use their mobile devices for study frequently, while 100% of females aged 29-33 have indicated that devices are very frequently used for study. 50% of females surveyed between the ages of 34-39 indicated that their mobile devices are used very frequently for leisure purposes, while the other 50% of females in this age bracket stipulate a frequent use of mobile devices for study purposes. In the over 40s age group, they indicate that mobile devices are very frequently used for study purposes by 25.93% of the group, while 33.33% of the over 40s show that frequent use of devices is towards study activities. 14.81% aged 40 and over shows that devices are sometimes used, and the same percentage of 14.81% show that mobile devices and are not used at all for study purposes. Leaving 11.11% of those in the 40+ age bracket not using mobile devices that much for study purposes.

Table 10.

Answers to Question 3, grouped by male age groups

Q3. How frequently are mobile devices (e.g. phones, Laptop, Tablet) used for formal studying?										
Age groups	Very frequently		Frequently		Sometimes		Not that much		Not at all	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	**100.00%**	1	0.00%	0	0.00%	0	0.00%	0
29-33	**100.00%**	3	0.00%	0	0.00%	0	0.00%	0	0.00%	0
34-39	**50.00%**	2	**50.00%**	2	0.00%	0	0.00%	0	0.00%	0
40+	**25.93%**	7	**33.33%**	9	**14.81%**	4	**11.11%**	3	**14.81%**	4

Table 10 refers to the answers obtained from male participants for Question 3. As the table implies, there is a 50-50 split between the very frequent use and not that much use of devices for study purposes for males aged 29-33. There is a difference between males over 40 as 75% of males frequently used mobile devices to study, and only 25% of the same age group indicate very frequently.

An analysis of Question 4

Table 11.

A brief summary of answers to Question 4

Q4. How frequently are mobile devices (e.g. phones, Laptop, Tablet) used for leisure? (E.G. Playing music or games)		
Answer Choices	Responses	
Very frequently	53.66%	22
Frequently	36.59%	15
Sometimes	2.44%	1
Not that much	7.32%	3
Not at all	0.00%	0

Table 11 provides the responses for Question 4. 53.66% (or 22 participants) indicate that mobile devices are used for leisure activities very frequently. 36.59% (or 15 participants) posit that their devices are frequently used for leisure. 2.44% (or one participant) states that his/her devices are used sometimes for leisure. With 7.32% of participants not using their devices much for leisure activities.

Table 12.

Answers to Question 4, grouped by gender

Q4. How frequently are mobile devices (e.g. phones, laptop, tablets) used for leisure? (E.G. Playing music or games)										
	Very frequently		Frequently		Sometimes		Not that much		Not at all	
Female	60.00%	21	31.43%	11	2.86%	1	5.71%	2	0.00%	0
Male	16.67%	1	66.67%	4	0.00%	0	16.67%	1	0.00%	0

Table 12 reveals that 60% of females and 16.67% of males state that mobile devices are very frequently used for leisure. 31.43% of females and 66.67% of males agree to frequent use of devices for leisure, with 2.86% of females indicate using their devices sometimes. Finally, 5.71% of females and 16.67% of males claim that their devices are not used as much for leisure purposes.

Table 13.

Answer to Question 4, grouped by female age groups

Q4. How frequently are mobile devices (e.g. phones, Laptop, Tablet) used for leisure? (E.G. Playing music or games)										
	Very frequently		Frequently		Sometimes		Not that much		Not at all	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	**100.00%**	1	0.00%	0	0.00%	0	0.00%	0	0.00%	0
29-33	**100.00%**	3	0.00%	0	0.00%	0	0.00%	0	0.00%	0
34-39	**100.00%**	4	0.00%	0	0.00%	0	0.00%	0	0.00%	0
40+	**48.15%**	13	**40.74%**	11	**3.70%**	1	**7.41%**	2	0.00%	0

Table 13 displays the results for question 4 grouped by female age groups. With 100% of females aged between 24 and 39 conveying that devices are used very frequently for leisure. 48.15% of females over the age of 40 indicated that they used their devices very frequently for leisure while 40.74% of females in this age group showed a frequent use of mobile devices for leisure, with 7.41% saying that their devices were not used that much, and 3.7% showing that sometimes their devices were used for leisure.

Table 14.

Answers to Question 4, grouped by male age groups

Q4. How frequently are mobile devices (e.g. phones, Laptop, Tablet) used for leisure? (E.G. Playing music or games)										
	Very frequently		Frequently		Sometimes		Not that much		Not at all	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
29-33	0.00%	0	**100.00%**	2	0.00%	0	0.00%	0	0.00%	0
34-39	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
40+	**25.00%**	1	**50.00%**	2	0.00%	0	**25.00%**	1	0.00%	0

Table 14 shows the responses from male participants regarding Question 4 of the survey on their use of mobile devices for leisure. 100% of male participants aged 29-33 agreed frequently using their devices for leisure. 50% of the 40+ age group indicate frequent use of devices for leisure, while 25% of the over 40s indicate either very frequent use of mobile devices for leisure or only sometimes using their mobile devices for leisure.

To summarise, an analysis was performed on questions pertaining to the regular and frequent use of devices for study and leisure. The following analysis addresses mobile devices used to support formal learning and improve study productivity.

4.1.3 **Mobile devices support and improve learning productivity**

The following data addresses the use of devices and if they can be used to support formal learning, as well as being used to improve and increase the learning productivity according to what participants (of the survey) have experienced.

An analysis of Question 5

Table 15.

A brief summary of answers to Question 5

Q5. In your experience, devices (e.g. phones, Laptop, Tablet) can be used to support formal learning.		
Answer Choices	Responses	
Strongly agree	62.50%	25
Agree	32.50%	13
Neither agree nor disagree	5.00%	2
Disagree	0.00%	0
Strongly disagree	0.00%	0

Table 15 shows that 62.50% of participants strongly agree that mobile devices can be used to support formal learning. 32.50% agree with the same notion, while 5% are neutral on the subject.

Table 16.

Answers to Question 5, grouped by gender

Q5. In your experience, devices (e.g. phones, Laptop, Tablet) can be used to support formal learning.										
	Strongly agree		Agree		Neither agree nor disagree		Disagree		Strongly disagree	
Female	58.82%	20	35.29%	12	5.88%	2	0.00%	0	0.00%	0
Male	83.33%	5	16.67%	1	0.00%	0	0.00%	0	0.00%	0

Table 16 describes the response per gender. 58.82% of female participants indicate that they strongly agree with devices being used to support formal learning, as male participants show that 83.33% strongly agree too. 35.29% of females agree on using devices to support formal learning, while 16.67% of males state the same thing. 5.88% of females are unbiased when addressing the use of devices to support formal learning support.

Table 17.

Answers to Question 5, grouped by female age groups

Q5. In your experience, devices (e.g. phones, Laptop, Tablet) can be used to support formal learning.										
	Strongly agree		Agree		Neither agree nor disagree		Disagree		Strongly disagree	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	**100.00%**	1	0.00%	0	0.00%	0	0.00%	0
29-33	**66.67%**	2	**33.33%**	1	0.00%	0	0.00%	0	0.00%	0
34-39	**100.00%**	4	0.00%	0	0.00%	0	0.00%	0	0.00%	0
40+	**53.85%**	14	**38.46%**	10	**7.69%**	2	0.00%	0	0.00%	0

Table 17 shows that 100% of females aged 34-39 strongly agree with the notion that mobile devices can be used to support formal learning, with 66.67% of females aged 29-33 and 53.83% females aged 40 and over also strongly agree with the notion. Furthermore, 100% of females aged 24-28 agree that mobile devices support formal learning, along with 33.33% of

females aged 29-33 and 38.46% of females aged over 40. However, 7.69% of females aged over 40 are indecisive and neither agree nor disagree with the idea of mobile devices having a supportive role with formal learning.

Table 18.

Answers to Question 5 grouped by male age groups

Q5. In your experience, devices (e.g. phones, Laptop, Tablet) can be used to support formal learning.										
	Strongly agree		Agree		Neither agree nor disagree		Disagree		Strongly disagree	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
29-33	**50.00%**	1	**50.00%**	1	0.00%	0	0.00%	0	0.00%	0
34-39	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
40+	**100.00%**	4	0.00%	0	0.00%	0	0.00%	0	0.00%	0

Males over the age of 40 absolutely and strongly agree that mobile devices can be used to support individuals with their learning within the formal learning environment. Males aged 29-33 show a 50-50 split, as 50% of them strongly agree, while the other 50% agree (see Table 18).

An analysis of Question 6

Table 19.

A brief summary of answers to Question 6

Q6. In your experience, devices (e.g. phones, Laptop, Tablet) can improve formal studying productivity.		
Answer Choices	Responses	
Strongly agree	56.10%	23
Agree	34.15%	14
Neither agree nor disagree	7.32%	3
Disagree	2.44%	1
Strongly disagree	0.00%	0

Table 19 reveals that 56.10% of participants strongly agree with the idea that using devices can improve learning productivity. Furthermore, 34.14% of participants agree with devices and the improvement of learning productivity, with 7.32% neither agreeing nor disagreeing

with this idea, and 2.44% of participants disagreeing that devices and their use can increase formal learning productivity.

Table 20.

Answers to Question 6, grouped by gender

Q6. In your experience, devices (e.g. phones, laptop, tablets) can improve formal studying productivity.										
	Strongly agree		Agree		Neither agree nor disagree		Disagree		Strongly disagree	
Female	48.57%	17	40.00%	14	8.57%	3	2.86%	1	0.00%	0
Male	100.00%	6	0.00%	0	0.00%	0	0.00%	0	0.00%	0

Table 20 reveals answers to Question 6 grouped by gender. Females at 48.57% and males at 100% strongly agree with devices being used to improve the productivity of formal study.

Table 21.

Answers to Question 6, grouped by female age groups

Q6. In your experience, devices (e.g. phones, laptop, tablets) can improve formal studying productivity.										
	Strongly agree		Agree		Neither agree nor disagree		Disagree		Strongly disagree	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	0.00%	0	**100.00%**	1	0.00%	0	0.00%	0
29-33	**66.67%**	2	**33.33%**	1	0.00%	0	0.00%	0	0.00%	0
34-39	**100.00%**	4	0.00%	0	0.00%	0	0.00%	0	0.00%	0
40+	**40.74%**	11	**48.15%**	13	**7.41%**	2	**3.70%**	1	0.00%	0

Table 21 shows that 100% of females aged 34-39 strongly agree with the statement on using devices to improve productivity. 66.67% of females aged 29-33 and 40.47% aged over 40 also strongly agree. Also, note that the remaining 33.33% of females aged 29-33 agree, and 48.15% of females who are over 40 years of age agree that devices can improve study productivity in a formal setting. Additionally, 3.70% of the females, those in the 40+ age bracket disagree with the idea. 7.41% of participants in this age group neither agree nor disagree with the statement, which is supported by 100% of female participants who fall into the 24-28 age group.

Table 22.

Answers on Question 6 grouped by male age groups

Q6. In your experience, devices (e.g. phones, Laptop, Tablet) can improve formal studying productivity.										
	Strongly agree		Agree		Neither agree nor disagree		Disagree		Strongly disagree	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
29-33	**100.00%**	2	0.00%	0	0.00%	0	0.00%	0	0.00%	0
34-39	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
40+	**100.00%**	4	0.00%	0	0.00%	0	0.00%	0	0.00%	0

All males who participated in this survey strongly agree that productivity can improve when using mobile devices (see Table 22 above).

To summarise, descriptive statistics were applied to analyse data collected from Question 5 and Question 6. The next section analyses Question 7, which refers to apps used for learning per the experience of participants.

4.1.4 Mobile apps used for learning

These are the descriptive statistics of data that question the apps that can be used for formal learning.

An analysis of Question 7

Table 23.

A brief summary of answers to Question 7

Q7. In your experience, what types of apps can be used for formal studying? (Please select all that apply)		
Answer Choices	Responses	
Tools	85.37%	35
Games	58.54%	24
Business	63.41%	26
Education	90.24%	37
Photography	63.41%	26
Social media	68.29%	28
Music and audio	68.29%	28
Health and fitness	53.66%	22
Books & references	87.80%	36

Video players and editors	60.98%	25

Question 7 is a multi-answer question, meaning participants can select more than one answer. Table 23 shows that 85.37% of participants selected Tools, 58.54% selected Games, 63.41% chose Business, 90.24% chose Education, 63.41% picked Photography, 68.29% selected Social media, Music and audio, 87.80% picked Books and references, and Video players and editors with 60.98% of responses.

Table 24.

Answers to Question 7, grouped by gender

Q7. In your experience, what types of apps can be used for formal studying? (Please select all that apply)				
Answer Choices	Female		Male	
Tools	82.86%	29	100.00%	6
Games	62.86%	22	33.33%	2
Business	65.71%	23	50.00%	3
Education	91.43%	32	83.33%	5
Photography	65.71%	23	50.00%	3
Social media	68.57%	24	66.67%	4
Music and audio	65.71%	23	83.33%	5
Health and fitness	51.43%	18	66.67%	4
Books & references	91.43%	32	66.67%	4
Video players and editors	60.00%	21	66.67%	4

Table 24 reveals responses for female and male participants for Question 7. Tools are a prominent feature for both gender groups, with 82.86% of females and 100% of males. Games 62.86% of female and 33.33% of male, Business 65.71% of female and 50% of male, Education 91.43% of female and 83.33% of male, Photography 65.71% of female and 50% of male, Social media 68.57% of female and 66.67% of male, Music and audio 65.71% of female and 83.33% of male. Female responses to Health and fitness 51.43%, Books and references 91.43% and Video players and editors 60%, yet 66.67% of males selected this answer.

Table 25.

Answers to Question 7, grouped by female age groups

Q7. In your experience, what types of apps can be used for formal studying? (Please select all that apply)										
Answers	18-23		24-28		29-33		34-39		40+	
Tools	0.00%	0	**100.00%**	1	**100.00%**	3	**100.00%**	4	**77.78%**	21
Games	0.00%	0	**100.00%**	1	**100.00%**	3	**75.00%**	3	**55.56%**	15
Business	0.00%	0	**100.00%**	1	**100.00%**	3	**75.00%**	3	**59.26%**	16
Education	0.00%	0	**100.00%**	1	**100.00%**	3	**75.00%**	3	**92.59%**	25
Photography	0.00%	0	**100.00%**	1	**100.00%**	3	**75.00%**	3	**59.26%**	16
Social media	0.00%	0	**100.00%**	1	**100.00%**	3	**75.00%**	3	**62.96%**	17
Music and audio	0.00%	0	**100.00%**	1	**100.00%**	3	**100.00%**	4	**55.56%**	15
Health and fitness	0.00%	0	**100.00%**	1	**100.00%**	3	**50.00%**	2	**44.44%**	12
Books & references	0.00%	0	**100.00%**	1	**100.00%**	3	**75.00%**	3	**92.59%**	25
Video players and editors	0.00%	0	**100.00%**	1	**100.00%**	3	**75.00%**	3	**51.85%**	14

Table 25 demonstrates female responses to Question 7 according to their age groups. Females aged 24-33 indicated that every kind of app is used and yet 100% of females aged 34-39 selected Tools, Music and audio, only 2/10 of the possible options presented in the survey. 75% of females in the 34-39 age group selected Games; Business; Education; Photography; Social media; Books and references and Video players and editors as essential apps in mobile devices, and finally 50% chose Health and fitness apps.

The 40+ female participants showed the most variance in terms of app selection: 92.59% selected Education; Books and reference as their highest app selection for formal study, and 77.78% selected Tools. While 62.96% selected Social media apps, 59.26% of the female 40+ age group selected Business; and Photography apps. 55.66% chose Games; Music and audio, 51.85% Video player and audio apps for formal study, and lastly 44.44% selected Health and fitness apps for use for formal study.

Table 26.

Answers to Question 7, grouped by male age group

Q7. In your experience, what types of apps can be used for formal studying? (Please select all that apply)										
Answer Choices	18-23		24-28		29-33		34-39		40+	
Tools	0.00%	0	0.00%	0	**100.00%**	2	0.00%	0	**100.00%**	4
Games	0.00%	0	0.00%	0	**50.00%**	1	0.00%	0	**25.00%**	1
Business	0.00%	0	0.00%	0	0.00%	0	0.00%	0	**75.00%**	3
Education	0.00%	0	0.00%	0	**50.00%**	1	0.00%	0	**100.00%**	4
Photography	0.00%	0	0.00%	0	**50.00%**	1	0.00%	0	**50.00%**	2
Social media	0.00%	0	0.00%	0	**50.00%**	1	0.00%	0	**75.00%**	3
Music and audio	0.00%	0	0.00%	0	**100.00%**	2	0.00%	0	**75.00%**	3
Health and fitness	0.00%	0	0.00%	0	**100.00%**	2	0.00%	0	**50.00%**	2
Books & references	0.00%	0	0.00%	0	**50.00%**	1	0.00%	0	**75.00%**	3
Video players and editors	0.00%	0	0.00%	0	**50.00%**	1	0.00%	0	**75.00%**	3

Table 26 reveal answers from the male participants grouped by their age with percentages and frequencies. 100% of males age 29-33 selected Tools; Music and audio; Health and fitness. 50% of the same age group selected Games; Education; Photography; Social media; Books and references, and Video players and Editors. 100% of males aged 40+ picked Tools; Education. 75% of them chose Business; Social media; Music and audio; Books and References; Video player and editors. 50% of males aged 40+ chose Photography and Health and fitness. With 25% selecting Games.

To summarise, Question 7 listed various kinds of apps and asked if the listed apps can be considered for learning. Quantitative analysis in the form of descriptive statistics was performed. The next section analyses Questions 9, 11 and 13 that refer to tasks being performed using mobile devices.

4.1.5 **Performing tasks using mobile devices**

This section will cover the analysis that addresses the use of mobile devices for performing tasks that are associated with formal learning.

An analysis of Question 9

Table 27.

A brief summary of answers to Question 9

Q9. In your experience, using a smartphone can, (please select all that apply)		
Answer Choices	Responses	
Access academic information easier and faster.	73.17%	30
Make note taking easier and faster.	63.41%	26
Make report writing easier and faster.	31.71%	13
Surf the Internet easier and faster.	75.61%	31
N/A - Not applicable	9.76%	4

Question 9 is a multi-answer question, meaning participants can select more than one answer; the answers reflect basic tasks that can be performed using devices. Table 27 shows a brief summary of the responses for Question 9, as 71.17% of participants selected Access academic information, 63.41% of participants selected Make note taking simple and faster, 31.71% of participants selected Make report writing easy and fast, 75.61% selected Surf the Internet easier and faster with 9.76% indicating that Question 9 is Not Applicable.

Table 28.

Answers to Question 9, grouped by gender

Q9. In your experience, using a smartphone can, (please select all that apply)									
	Access academic information easier and faster.		Make note taking easier and faster.		Make report writing easier and faster.		Surf the Internet easier and faster.		N/A - Not applicable	
Female	76.47%	26	67.65%	23	35.29%	12	76.47%	26	11.76%	4
Male	66.67%	4	50.00%	3	16.67%	1	83.33%	5	0.00%	0

Table 28 reveals that 76.47% of female and 66.67% of male participants chose Access academic information easier and faster. 67.65% of female and 50% of male participants selected Make note taking easier and faster. 35.29% of female and 16.67% of male

participants answered with Make report writing easier and faster. 76.47% of female and 83.33% of male participants chose Surf the Internet easier and faster, with 11.76% of female participants do not see smartphones as applicable.

Table 29.

Answers to Question 9, females grouped by age groups

Q9. In your experience, using a smartphone can,										
	Access academic information easier and faster.		Make note taking easier and faster.		Make report writing easier and faster.		Surf the Internet easier and faster.		N/A - Not applicable	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	0.00%	0	**100%**	1	**100%**	1	0.00%	0
29-33	**100%**	3	**100%**	3	**33.33%**	1	**100%**	3	0.00%	0
34-39	**75.00%**	3	**100%**	4	**25.00%**	1	**100%**	4	0.00%	0
40+	**76.92%**	20	**61.54%**	16	**34.62%**	9	**69.23%**	18	**15.38%**	4

Table 29 reveals that 100% of female participants aged 24-28 selected Make report writing easier and faster; Surf the Internet faster and easier. 100% aged 29-33 chose Access academic information, Make note taking easier, Surf the Internet easier and faster, and 33.33% of them selected Make report writing easier and faster. 100% of female participants aged 34-39 reveals that smartphones can Make note taking and Surfing the Internet easier and faster, 75% chose Access academic information, 25% selected Make report writing easier and faster. 76.92% of females aged 40+ selected Access academic information, 61.54% chose Make note taking easier and faster, 34.62% selected Make report writing easier and faster, with 69.23% chose Surf the Internet easier and faster while 15.38% chose N/A – Not applicable.

Table 30 is an extension of Table 29 by analysing female age groups who selected multiple answers to Question 9.

Table 30.

Number of tasks, using a smartphone, grouped by female age groups

Q9. In your experience, using a smartphone can, (please select all that apply)										
	One task		Two tasks		Three tasks		Four tasks		N/A	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	**100.00%**	1	0.00%	0	0.00%	0	0.00%	0
29-33	0.00%	0	0.00%	0	**66.66%**	2	**33.33%**	1	0.00%	0
34-39	0.00%	0	**25.00%**	1	**25.00%**	1	**50.00%**	2	0.00%	0
40+	**18.52%**	5	**7.40%**	2	**22.22%**	6	**33.33%**	9	**18.52%**	5

Table 30 tells us that females aged 24-28 indicate that two tasks are ample for use during learning. 66.66% of females aged 29-33 indicate that using three tasks, while 33.33% stated performing four tasks. Females aged 34-39, 50% of them perform four tasks, 25% show support for two tasks and 25% performing three tasks. 18.52% of females aged 40+ indicate that using a phone in their experience is good for one task to aid them with studying activities. Also note, 7.40% of them have indicated using devices for two tasks can help them with learning. 22.22% of females over 40 stated performing three tasks was sufficient. 33.33% of them agree that performing four tasks can help with learning, while 18.52% chose N/A.

Table 31.

Answers to Question 9, grouped by male age groups

Q9. In your experience, using a smartphone can,										
	Access academic information easier and faster.		Make note taking easier and faster.		Make report writing easier and faster.		Surf the Internet easier and faster.		N/A - Not applicable	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
29-33	**50.00%**	1	**50.00%**	1	0.00%	0	**100.00%**	2	0.00%	0
34-39	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
40+	**75.00%**	3	**50.00%**	2	**25.00%**	1	**75.00%**	3	0.00%	0

Table 31 reveals 50% of male participants aged 29-33 selected Access academic information as well as Make note taking easier, and 100% of these males picked Surf the Internet. Male participants aged 40+, 75% of them selected Access academic information, Surf the Internet easier and faster, 50% chose Make note taking easier, 25% of the aged 40+ chose Make note taking easier.

Table 32 is an extension of Table 31 by analysing the male age groups who selected multiple answers (tasks) when answering Question 9.

Table 32.

Number of tasks, using a smartphone, grouped by male age groups

Q9. In your experience, using a smartphone can, (please select all that apply)										
	One task		Two tasks		Three tasks		Four tasks		N/A	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
29-33	**50.00%**	1	0.00%	0	**50.00%**	1	0.00%	0	0.00%	0
34-39	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
40+	**50.00%**	2	0.00%	0	**25.00%**	1	**25.00%**	1	0.00%	0

Table 32 addresses the male answers. 50% of males aged 29-30 in their experience use their phones for one task related to their learning, while the remaining 50% expressed using at least three tasks that can aid them in their learning. As for males aged 40 and over, 50% signify using at least one task for learning purposes, 25% at least three, while the other 25% is four tasks.

An analysis of Question 11

Table 33.

A brief summary of answers to Question 11

Q11. In your experience, using a tablet can, (please select all that apply)		
Answer Choices	Responses	
Access academic information easier and faster.	65.85%	27
Make note taking easier and faster.	65.85%	27
Make report writing easier and faster.	48.78%	20
Surf the Internet easier and faster.	73.17%	30
N/A - Not Applicable	9.76%	4

Table 33 summarises the response from participants, 65.85% chose Access academic information easier and faster as well as Make note taking easier. 48.78% of participants selected Make reports writing easier and faster. 73.17% chose Surf the Internet, and 9.76% chose NA – Not Applicable.

Table 34.

Answers to Question 11 grouped by gender

Q11. In your experience, using a tablet can, (please select all that apply)										
	Access academic information easier and faster.		Make note taking easier and faster.		Make report writing easier and faster.		Surf the Internet easier and faster.		N/A - Not Applicable	
Female	67.65%	23	70.59%	24	52.94%	18	73.53%	25	11.76%	4
Male	66.67%	4	50.00%	3	33.33%	2	83.33%	5	0.00%	0

Table 34 shows the answers given by male and female participants. 67.65% of female and 66.67% male participants selected Access academic information. 70.59% of female and 50% of male participants selected Make note taking easier and faster. 52.94% of female and 33.33% of male participants chose Male report writing easier. 73.53% of female and 83.33% of male participants chose Surf the Internet and 11.76% of females chose NA.

Table 35.

Answers to Question 11 grouped by female age groups

Q.11 In your experience, using a tablet can, (please select all that apply)										
	Access academic information easier and faster.		Make note taking easier and faster.		Make report writing easier and faster.		Surf the Internet easier and faster.		N/A - Not Applicable	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	**100.00%**	1	**100.00%**	1	**100.00%**	1	0.00%	0
29-33	**100.00%**	3	**100.00%**	3	**33.33%**	1	**100.00%**	3	0.00%	0
34-39	**100.00%**	4	**100.00%**	4	**75.00%**	3	**100.00%**	4	0.00%	0
40+	**61.54%**	16	**61.54%**	16	**50.00%**	13	**65.38%**	17	**15.38%**	4

Table 35 shows that 100% of females aged 24-28 agree that using a tablet Makes note taking easier, Make report writing easier, and Surf the Internet easier. 100% of females aged 29-33 agree on Access academic information easier, Make note taking easier, Surf the Internet easier, and 33.33% selected Make report writing easier. 100% of females aged 34-39 agree on Access academic information easier, Make note taking easier, Surf the Internet easier, with 75% of them selected Make report writing easier and faster. 61.54% of females aged 40+ selected Access academic information easier and Make note taking easier, 50% of them chose

Make report easier, 65.38% chose Surf the Internet easier, while 15.38% indicated Not Applicable.

Table 36 expands from Table 35 by analysing the female age groups who selected multiple answers (tasks) to Question 11.

Table 36.

Number of tasks, using a tablet, grouped by female age groups

Q11. In your experience, using a tablet can, (please select all that apply)										
	One task		Two tasks		Three tasks		Four tasks		N/A	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	0.00%	0	**100.00%**	1	0.00%	0	0.00%	0
29-33	0.00%	0	0.00%	0	**66.66%**	2	**33.33%**	1	0.00%	0
34-39	0.00%	0	0.00%	0	0.00%	0	**100.00%**	4	0.00%	0
40+	**25.92%**	7	**7.40%**	2	**3.70%**	1	**44.44%**	12	**18.51%**	5

Table 36 relates to the answers given by females per age group for Question 11. 100% of participants aged 24-28 will use at least three tasks on a tablet associated with studying. 66.66% aged 29-33 expressed that they will use at least three tasks on a tablet for learning, while the remaining 33.33% indicates at least four tasks will be used on a tablet while studying. 100% aged 34-39 will use at least four tasks on a tablet. Participants aged 40 and over show that 25.92% will use at least one capability, 7.40% at least two tasks, 3.70% at three tasks, 44.44% with four tasks and 18.51%.

Table 37.

Answers to Question 11, grouped by male age group

Q11. In your experience, using a tablet can, (please select all that apply)										
	Access academic information easier and faster.		Make note taking easier and faster.		Make report writing easier and faster.		Surf the Internet easier and faster.		N/A - Not Applicable	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
29-33	**50.00%**	1	**100.00%**	2	**50.00%**	1	**100.00%**	2	0.00%	0
34-39	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
40+	**75.00%**	3	**25.00%**	1	**25.00%**	1	**75.00%**	3	0.00%	0

Table 37 show males aged 29-33 that 50% chose both Access academic information easier as well as Make report writing easier, also 100% chose both the Make note taking easier as well as Surf the Internet easier. Males aged 40+ show that 75% selected Access academic information easier and selected Surf the Internet easier.

Table 38 is an extension of Table 37 by analysing the male age groups who selected multiple answers to Question 11.

Table 38.

Number of tasks, using a tablet, grouped by male age groups

Q11. In your experience, using a tablet can, (please select all that apply)										
	One task		Two tasks		Three tasks		Four tasks		N/A	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
29-33	0.00%	0	**50.00%**	1	0.00%	0	**50.00%**	1	0.00%	0
34-39	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
40+	**50.00%**	2	**25.00%**	1	0.00%	0	**25.00%**	1	0.00%	0

Table 38 shows the results males provided for Question 11. 50% of males aged 29-33 agreed on using at least two tasks to aid with their learning, while the other 50% stated that using at least four is possible. 50% of males aged 40+ have indicated that one task is performed using a tablet, 25% of the same age group selected performing two tasks and four tasks.

An analysis of Question 13

Table 39.

A brief summary of answers to Question 13

Q13. In your experience, using a laptop can, (please select all that apply)		
Answer Choices	Responses	
Access academic information easier and faster.	85.37%	35
Make note taking easier and faster.	63.41%	26
Make report writing easier and faster.	82.93%	34
Surf the Internet easier and faster.	75.61%	31
N/A - Not Applicable	2.44%	1

Table 39 demonstrates a brief summary of the answers to Question 13. 85.37% participants responded to Access academic information easier, 63.41% responded with Make note taking

easier, 82.93% answered with Make report writing easier, 75.61% answered with Surf the Internet easier and faster, while 2.44% responded with N/A

Table 40.

Answers to Question 13 grouped by gender

Q13. In your experience, using a laptop can, (please select all that apply)										
	Access academic information easier and faster.		Make note taking easier and faster.		Make report writing easier and faster.		Surf the Internet easier and faster.		N/A - Not Applicable	
Female	85.71%	30	65.71%	23	82.86%	29	77.14%	27	2.86%	1
Male	83.33%	5	50.00%	3	83.33%	5	66.67%	4	0.00%	0

Table 40 reveals that 85.71% of females and 83.71% of males chose Access academic information easier. 65.71% of females and 50% of males chose Make note taking easier, 82.86 of females and 83.33% of males chose Make report writing easier, 77.14% of females and 66.67% chose Surf Internet easier and faster. Only 2.86% of female respondents felt that this question was not applicable to them.

Table 41.

Answers to Question 13 grouped by female age groups

Q13. In your experience, using a laptop can, (please select all that apply)										
	Access academic information easier and faster.		Make note taking easier and faster.		Make report writing easier and faster.		Surf the Internet easier and faster.		N/A-Not Applicable	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	**100.00%**	1	**100.00%**	1	**100.00%**	1	**100.00%**	1	0.00%	0
29-33	**100.00%**	3	**66.67%**	2	**100.00%**	3	**100.00%**	3	0.00%	0
34-39	**100.00%**	4	**25.00%**	1	**100.00%**	4	**75.00%**	3	0.00%	0
40+	**81.48%**	22	**70.37%**	19	**77.78%**	21	**74.07%**	20	**3.70%**	1

Table 41 reveals that 100% of females aged 24-28 answered with Access academic information; Make note taking, Make report writing, and Surf the Internet easier and faster. 100% of females aged 29-33 responded with Access academic information; Make report writing, and Surf the Internet easier and faster, 67.67% chose Make note taking easier. 100% of females aged 34-39 chose Access academic information easier; Make report writing easier, 75% of them chose Surf the Internet easier while 25% chose Make note taking easier and

faster. Females aged 40+, 81.48% of these participants chose Access academic information, 70.37% chose Make note taking easier, 77.78% chose Make report writing easier, 74.07% chose Surf the Internet easier while 3.70% chose N/A.

Table 42 expands from Table 41 by analysing the female age groups who selected multiple answers (tasks) to Question 13.

Table 42.

Number of tasks, using a laptop, grouped by female age groups

Q13. In your experience, using a laptop can, (please select all that apply)									
	One task		Two tasks		Three tasks		Four tasks		N/A	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	0.00%	0	0.00%	0	**100.00%**	1	0.00%	0
29-33	0.00%	0	0.00%	0	**33.33%**	1	**66.67%**	2	0.00%	0
34-39	0.00%	0	**25.00%**	1	**25.00%**	1	**50.00%**	2	0.00%	0
40+	**18.51%**	5	**7.40%**	2	**11.11%**	3	**59.25%**	16	**3.70%**	1

Table 42 displays female results for Question 13 and illustrates that females aged 24-28 100% agree when using a laptop for learning purpose they will use at least four tasks. 33.33% of female respondents aged 29-33 will use at least three tasks, while 66.67% will use four tasks for learning. 25% of those aged 34-39 indicate that they use two to three tasks, while the remaining 50% pointed out performing four tasks. 18.51% of females aged 40+ indicated that one task is performed, 7.40% indicated two tasks, 11.11% have stated that three tasks are performed, with 59.25% indicated of performing four tasks, while 3.70% do not see laptops as applicable.

Table 43.

Answers to Question 13, grouped by male age groups

Q13. In your experience, using a laptop can, (please select all that apply)										
	Access academic information easier and faster.		Make note taking easier and faster.		Make report writing easier and faster.		Surf the Internet easier and faster.		N/A - Not Applicable	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
29-33	**100.00%**	2	**50.00%**	1	**100.00%**	2	**100.00%**	2	0.00%	0
34-39	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0

40+	**75.00%**	3	**50.00%**	2	**75.00%**	3	**50.00%**	2	0.00%	0

Table 43 reveals 100% of males aged 29-33 chose Access academic information easier along with Make report writing easier as well as Surf Internet easier, and 50% chose Make note taking. 75% of males 40+ years of age chose Access academic information coupled with Make report writing easier, 50% of them chose Make note taking easier, along with Surf the Internet easier and faster.

Table 44.

Number of tasks, using a laptop, grouped by male age groups

Q.13 In your experience, using a laptop can,										
	One task		Two tasks		Three tasks		Four tasks		N/A	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
29-33	0.00%	0	0.00%	0	**50.00%**	1	**50.00%**	1	0.00%	0
34-39	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
40+	**50.00%**	2	0.00%	0	0.00%	0	**50.00%**	2	0.00%	0

Table 44 reveals the answers for Question 13 by male participants.50% of male participants between the ages of 29-33 indicated using at least three tasks for learning purposes, while the other 50% shows that four tasks used for learning purpose while using a laptop. 50% of males over 40 revealed that they use one capability with the remaining indicating their use of four tasks when learning while using a laptop.

To summarise, analyses were applied to data compiled for Questions 9, 11 and 13 that address the tasks often performed on mobile devices that are associated with formal learning use of devices to support learning and enhance the study rate, and/or the study productivity. The next questions refer to discovering what devices are best suited for formal learning.

4.1.6 **Mobile devices (laptops, smartphones, tablets)**

Results from the survey that address mobile devices and identify devices, which are commonly used when individuals learn formally will be analysed.

An analysis of Question 8

Table 45.

A brief summary of answers to Question 8

Q8 In your experience, a smartphone is used for formal learning.		
Answer Choices	Responses	
Strongly agree	21.95%	9
Agree	43.90%	18
Neither agree nor disagree	26.83%	11
Disagree	4.88%	2
Strongly disagree	0.00%	0
N/A - Not applicable	2.44%	1

21.95% of participants strongly agree with smartphone usage for formal learning. Also, 43.90% of participants agree. Furthermore, 26.83% of participants have stayed neutral on the matter, while 4.88% disagree and 2.44% deem smartphones as not applicable (see Table 45).

Table 46.

Answers to Question 8, per gender

Q8 In your experience, a smartphone is used for formal learning.												
	Strongly agree		Agree		Neither agree nor disagree		Disagree		Strongly disagree		N/A	
Female	25.71%	9	42.86%	15	25.71%	9	2.86%	1	0.00%	0	2.86%	1
Male	0.00%	0	50.00%	3	33.33%	2	16.67%	1	0.00%	0	0.00%	0

25.71% of female participants indicate they strongly agree with smartphones for learning purposes. Followed by 42.86% of females that agree, where 25.71% of females and 33.33% of males are neutral towards smartphone usage for formal learning. 2.86% of females and 16.67% of males disagree with the notion of smartphone usage for learning. 2.86% of females claim that smartphones are not appropriate for learning and thus not applicable (see Table 46).

Table 47.

Answers to Question 8, grouped by female age groups

Q8. In your experience, a smartphone is used for formal learning.												
	Strongly agree		Agree		Neither agree nor disagree		Disagree		Strongly disagree		N/A	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	0.00%	0	**100.00%**	1	0.00%	0	0.00%	0	0.00%	0
29-33	**66.67%**	2	**33.33%**	1	0.00%	0	0.00%	0	0.00%	0	0.00%	0
34-39	**50.00%**	2	**50.00%**	2	0.00%	0	0.00%	0	0.00%	0	0.00%	0
40+	**18.52%**	5	**44.44%**	12	**29.63%**	8	**3.70%**	1	0.00%	0	**3.70%**	1

Table 47 depicts answers from female participants. When prompted with a Question on using phones for learning, 100% of females aged 24-28 neither agree nor disagree on phones being used for learning. Participants aged 29-33 indicate that 66.67% strongly agree, while the remaining 33.33% agree that phones are suitable for learning. A 50-50 split with those aged 34-39 with 50% strongly agrees while the remaining 50% agree that smartphones help with learning. At most with 44.44% of the over 40s agree, while 18.52% strongly agree, 29.63% neither agree nor disagree on phones used for learning purposes. 3.70% of the over 40s go towards NA and disagreement.

Table 48.

Answers to Question 8, grouped by male age groups

Q8. In your experience, a smartphone is used for formal learning.												
	Strongly agree		Agree		Neither agree nor disagree		Disagree		Strongly disagree		N/A	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
29-33	0.00%	0	0.00%	0	**50.00%**	**1**	**50.00%**	**1**	0.00%	0	0.00%	0
34-39	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
40+	0.00%	0	**75.00%**	**3**	**25.00%**	**1**	0.00%	0	0.00%	0	0.00%	0

Males aged 40 and over indicate that 75% strongly agree with the usage of phones for learning activities while the remaining 25% neither agree nor disagree. Males aged 29-33 shows a 50-50 split, with half opposed to phones used for learning, while the remaining participants of this age group neither agree nor disagree with the idea of using phones when learning (See Table 48).

An analysis of Question 10

Table 49.

A brief summary of answers to Question 10

Q10. In your experience, a tablet is used for formal learning.		
Answer Choices	Responses	
Strongly agree	29.27%	12
Agree	56.10%	23
Neither agree nor disagree	4.88%	2
Disagree	0.00%	0
Strongly disagree	4.88%	2
N/A - Not applicable	4.88%	2

Table 49 depicts the answers from all participants. 29.27% of participants strongly agree with the tablet being used for formal learning. Furthermore, 56.10% of participants agree with using tablets for formal learning. However, 4.88% show disinterest towards tablets being used, yet 4.88% of participants strongly disagree as well as not seeing how applicable devices such as tablets can be for formal learning.

Table 50.

Answers to Question 10, grouped by gender

Q8. In your experience, a tablet is used for formal learning.												
	Strongly agree		Agree		Neither agree nor disagree		Disagree		Strongly disagree		N/A	
Female	28.57%	10	57.14%	20	5.71%	2	0.00%	0	2.86%	1	5.71%	2
Male	33.33%	2	50.00%	3	0.00%	0	0.00%	0	16.67%	1	0.00%	0

Table 50 shows that 28.57% of female participants and 33.33% of male participants strongly agree with using tablets for formal learning. Furthermore, 57.14% of females and 50% of males agree on using mobile devices. Yet 5.71% of females are neutral, while 2.86% of females and 16.67% of males strongly disagree with tablets being used for formal learning.

Table 51.

Answers to Question 10, grouped by female age groups

Q10. In your experience, a tablet is used for formal learning.												
	Strongly agree		Agree		Neither agree nor disagree		Disagree		Strongly disagree		N/A	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	0.00%	0	**100.00%**	1	0.00%	0	0.00%	0	0.00%	0
29-33	**33.33%**	**1**	**66.67%**	**2**	0.00%	0	0.00%	0	0.00%	0	0.00%	0
34-39	**100.00%**	**4**	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
40+	**18.52%**	**5**	**66.67%**	**18**	**3.70%**	**1**	0.00%	0	**3.70%**	**1**	**7.41%**	2

Table 51 expresses that females within the ages of 34-39 all strongly agree on tablets being used for learning tasks, while all females aged 24-28 were neutral on tablets being used for learning activities. Furthermore, participants aged 29-33 agree 33.33%, and the remainder 66.67% agree. The over 40-year olds showed that 18.52% strongly agree, 66.67% agree, 3.70% neither agree nor disagree and strongly disagree, with the remaining 7.41% of this age group deeming it not applicable.

Table 52.

Answers to Question 10, grouped by male age groups

Q10. In your experience, a tablet is used for formal learning.												
	Strongly agree		Agree		Neither agree nor disagree		Disagree		Strongly disagree		N/A	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
29-33	0.00%	0	**50.00%**	1	0.00%	0	0.00%	0	**50.00%**	1	0.00%	0
34-39	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
40+	**50.00%**	2	**50.00%**	2	0.00%	0	0.00%	0	0.00%	0	0.00%	0

Table 52 shows, 50% of males aged 40+ strongly agree on tablets while the remaining 50% states that they agree, 50% of males aged 29-33 use tablets for formal learning while the remaining 50% have indicated that they strongly disagree with tablets being used.

An analysis of Question 12

Table 53.

A brief summary of answers to Question 12

Q12. In your experience, a laptop is used for formal learning.		
Answer Choices	Responses	
Strongly agree	56.10%	23
Agree	34.15%	14
Neither agree nor disagree	7.32%	3
Disagree	0.00%	0
Strongly disagree	2.44%	1
N/A - Not applicable	0.00%	0

The responses for Question 12 show that 56.10% strongly agree and 34.15% agree with the use of laptops for formal learning, with 7.15% of responded undecided. Finally, 2.44% of respondents strongly disagree with laptops being used for formal learning (see Table 53).

Table 54.

Answers to Question 12, grouped by gender

Q12. In your experience, a laptop is used for formal learning.											
	Strongly agree		Agree		Neither agree nor disagree		Disagree		Strongly disagree		N/A	
Female	54.29%	19	34.29%	12	8.57%	3	0.00%	0	2.86%	1	0.00%	0
Male	66.67%	4	33.33%	2	0.00%	0	0.00%	0	0.00%	0	0.00%	0

With the female participants, 54.29% and 66.67% of male participants indicate strongly agree with using laptops for formal learning, with 34.29% of females and 33.33% of males agree to laptops. Yet 8.57% of female participants are unsure, while 2.86% strongly disagree with the use of laptops for formal learning (see Table 54).

Table 55.

Answers to Question 12, grouped by female age groups

Q12. In your experience, a laptop is used for formal learning.												
	Strongly agree		Agree		Neither agree nor disagree		Disagree		Strongly disagree		N/A	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	0.00%	0	**100.00%**	1	0.00%	0	0.00%	0	0.00%	0
29-33	**66.67%**	2	**33.33%**	1	0.00%	0	0.00%	0	0.00%	0	0.00%	0
34-39	**75.00%**	3	0.00%	0	**25.00%**	1	0.00%	0	0.00%	0	0.00%	0
40+	**51.85%**	14	**40.74%**	11	**3.70%**	1	0.00%	0	**3.70%**	1	0.00%	0

Female participants who fall into the 24-28 age group 100% neither agree nor disagree that laptops can be a fitted option for performing learning tasks. 66.67% of those aged 29-33 strongly agree on laptops being appropriate for formal learning, while the remaining 33.33% agree. Participants aged 34-39 revealed 75% strongly agree, while the rest neither agree nor disagree with laptops being used for learning tasks. Just over half, at 51.85%, of participants who are 40 and older strongly agree with laptops being used, while 40.74% of this age group agree as well with the notion of laptop use for studying. Lastly, 3.70% state that they neither agree nor disagree and 3.70% strongly do not agree with the use of laptops for formal learning activities (see Table 55).

Table 56.

Answers to Question 12, grouped by male age groups

Q12. In your experience, a laptop is used for formal learning.												
	Strongly agree		Agree		Neither agree nor disagree		Disagree		Strongly disagree		N/A	
18-23	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
24-28	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
29-33	**50.00%**	1	**50.00%**	1	0.00%	0	0.00%	0	0.00%	0	0.00%	0
34-39	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
40+	**75.00%**	3	**25.00%**	1	0.00%	0	0.00%	0	0.00%	0	0.00%	0

Table 56 reveals that 50% of males aged 29-33 strongly agree about laptops being utilised for learning purposes and the other 50% state that they also agree, while males 40 years and older indicate that 75% of them strongly agree with the idea of laptops and the remaining 25% merely agree.

To summarise, Question 8, 10 and 12 were analysed using quantitative analysis. The following section analyses the survey results using qualitative analysis.

4.2 Qualitative results

For Qualitative analysis, inductive reasoning is applied by the author. The purpose of inductive reasoning is to produce meaning and understanding from data in an attempt to identify patterns, trends and connections to construct stories that will be used as the foundation for ideas and theories (Saunders et al., 2012).

4.2.1 Participant sub-group stories: Age groups

The following participant sub-groups are collected together according to the various age groups presented through data collection.

Those participants aged 24-28 used mobile devices (phone, tablet, laptop) frequently for formal study (4). This group of participants used the same mobile devices very frequently for leisure (playing games or listening to music) (5). This group also agreed that these same devices could be used to support formal learning (4). However, this same group of participants were neutral (neither agreed nor disagreed) about whether these mobile devices could improve formal study productivity (3). They were unanimous in stating that no matter what type the app was (tools, games, business, education, photography, social media, music, audio, health and fitness, and books and reference material) (5) they could all be used for formal study. This group was neutral about the use of smartphones for formal learning (3) and also stated that using a smartphone could make report writing more comfortable and faster, and they could surf the Internet a lot easier and faster (3). This group of participants was neutral about the use of tablets for formal learning (3). However, they did state that a tablet could make notetaking, report writing and surfing the Internet all easier and faster (4). This group was also neutral about using laptops for formal learning (3) and at the same time stated that laptops could make report writing more natural and faster, and they could surf the Internet with more ease and speed (3).

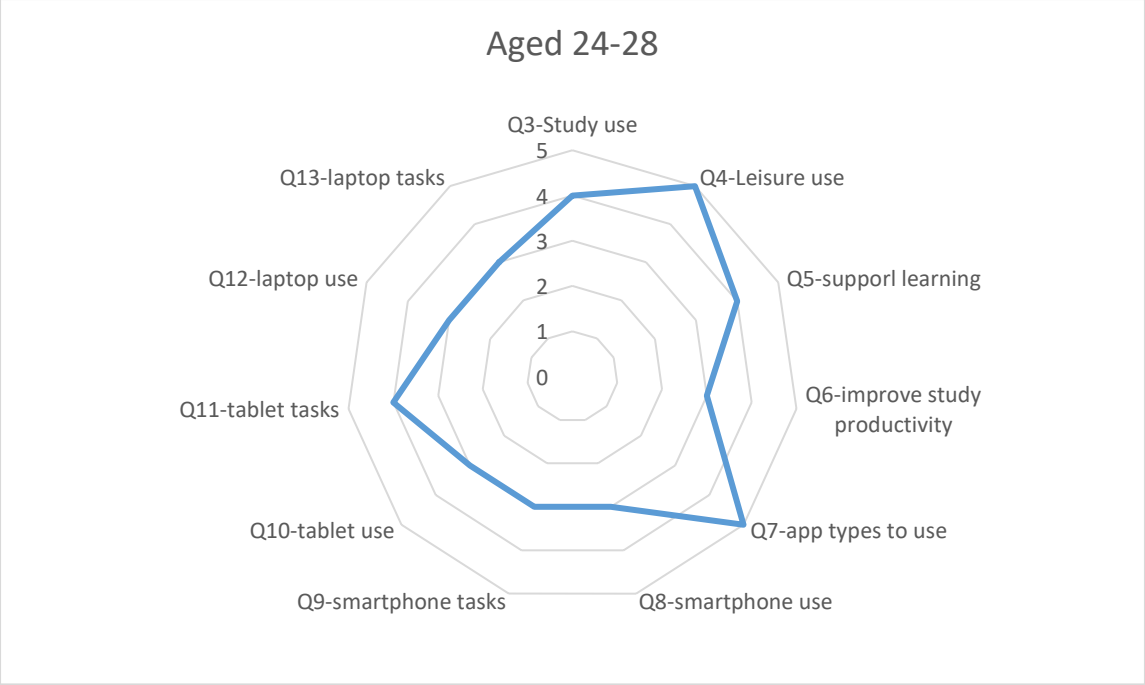


Figure 8. Participant sub-groups stories: Aged 24-28

Figure 8 shows a radar chart with 11 variables. With (5) being strongly agree/very frequent through to (1) being strongly disagree/not very frequent. Figure 8 is a graphical representation of answers given by individuals aged 24-28 who participated in the online survey.

Participants aged 29-33 frequently used mobile devices such as smartphones, tablets and laptops for formal learning (4). Furthermore, they also used their mobile devices for leisure purposes, such as listening to music or playing games (4). They shared the same notion and agreed that mobile devices can be used to support formal studying (4) and could improve formal learning productivity (4). The participants understood that using the various types of apps (tools, games, business, education, photography, social media, music, audio, health and fitness, and books and reference material) could be used for formal learning (5). This age group, regarding the use of smartphones for formal learning, approve and agree that smartphones can be used for learning (4). However, they all agree that using a smartphone can aid in surfing the Internet easier and faster (2). This group of participants suggests that tablets are used for formal learning (5) and state that the use of a tablet could make accessing information, notetaking, and surfing the Internet a lot easier and faster (4). They were unanimous in expressing that laptops should be used for formal learning (5) and those laptops make access to academic information, note taking, writing reports and surfing the Internet much easier and faster (5).

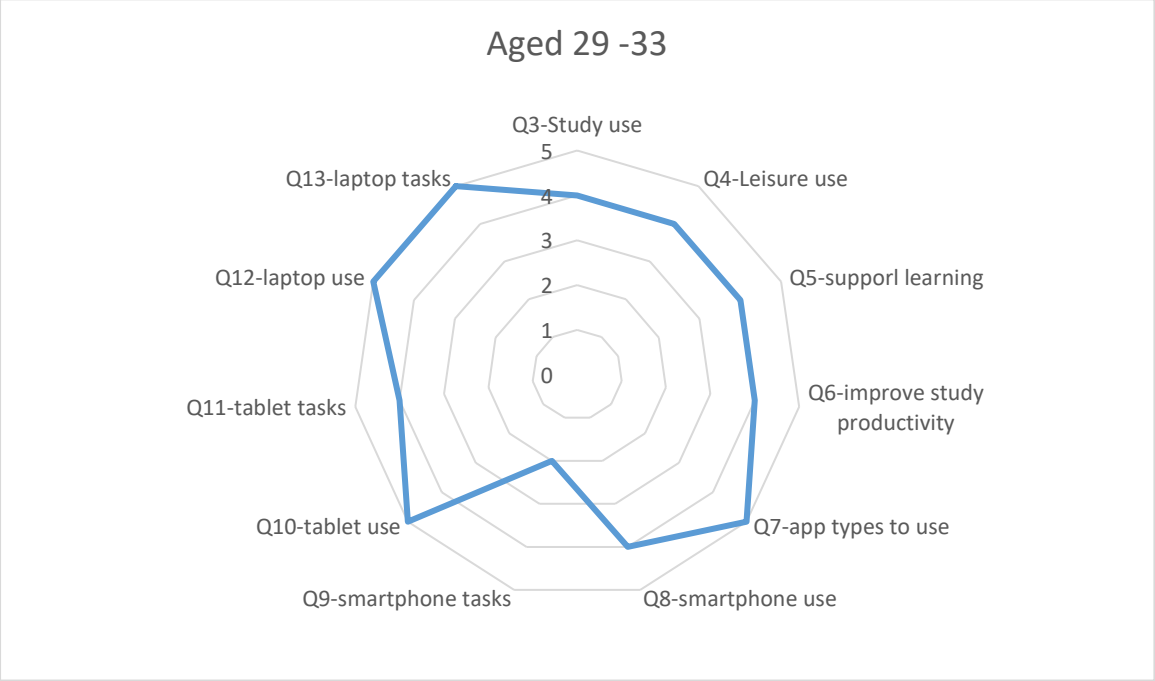


Figure 9. Participant sub-groups stories: Aged 29-33

Figure 9 is a graphical representation of answers provided by individuals aged 29-33 who participated in the online survey. A 5-point scale is used to depict the codes that correlate to the answers given by participants in the survey. With (5) being strongly agree/very frequent through to (1) being strongly disagree/not very frequent.

Participants aged 34-39 have indicated that they frequently use mobile devices (be it a smartphone, laptop or tablet) for formal learning (4) as well as being very frequent when used for leisure (playing games or social media) (5). This group of participants strongly agree that mobile devices can be used to support (5) and improve productivity regarding formal studying (5). There are indications that a wide range of apps (tools, games, business, photography, social media, music and audio, health and fitness, books and reference) can be used for formal learning (5). This group of participants united under the agreement of smartphone usage for formal learning (4) and stated that notetaking and surfing the Internet would be easier and faster using a smartphone (3). They were also unanimous in showing that tablets could be used for study (5) and stated that tablets could make formal learning easier and faster by accessing information, taking notes and surfing the Internet (4). There were disinterested parties in this group on the usage of laptops for formal learning (3) but did state that using laptops for formal learning could make tasks like accessing information, writing reports, taking notes and surfing the Internet more comfortable and faster (5).

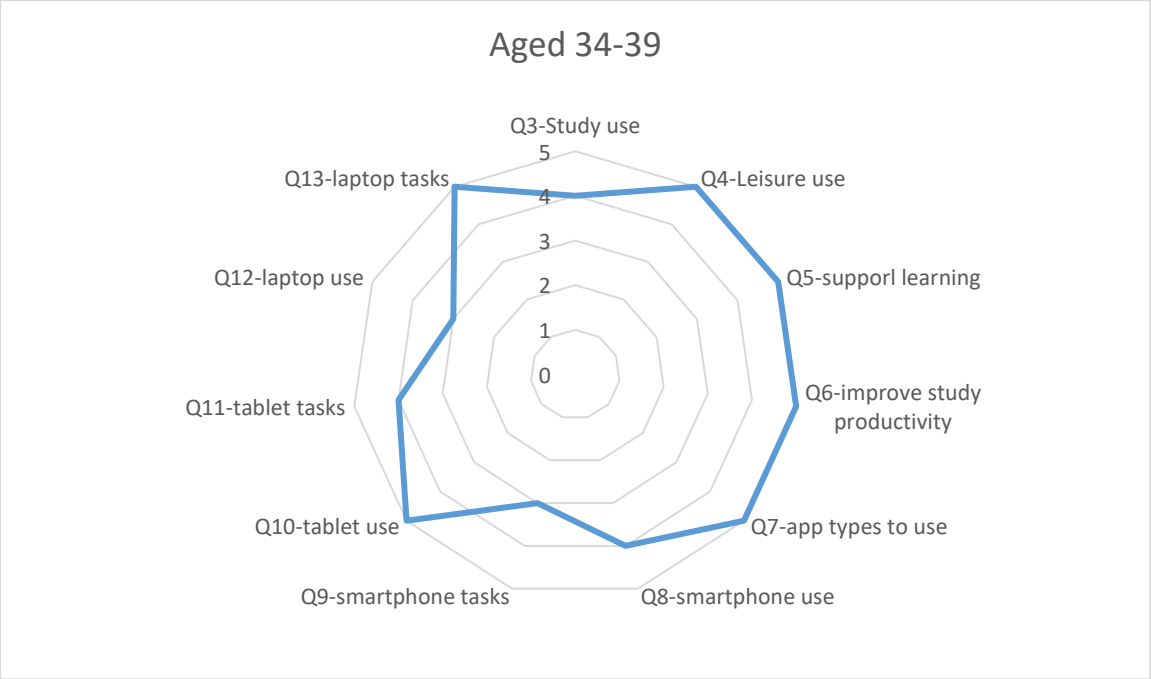


Figure 10. Participant sub-groups stories: Aged 34-39

Figure 10 is a graphical representation of answers given by people aged 34-39. A 5-point scale is used with (5) being strongly agree/very frequent through to (1) being strongly disagree/not very frequent.

Participants aged 40+ frequently use mobile devices (phone, tablet, laptop) for formal learning (4). The participants in this group show signs of using mobile devices for leisure (playing games and listening to music) (5), this group also agrees that mobile devices can be used to support formal learning (5) and can improve formal learning productivity (4). This group posits that using various type of apps, no matter the app (tools, games, business, photography, social media, music and audio, health and fitness, books and reference) could be used for formal studying (5). The majority of participants agree with the notion that smartphones can be used for learning (4), they conveyed that smartphones could make tasks such as accessing academic information, taking notes and surfing the Internet more straightforward and faster (4). Most participants in this group agree that tablets could be used for formal learning (4). Most of them comply that using a tablet can simplify tasks such as accessing information, surfing the Internet, note taking and report writing (5). Furthermore, many participants from this group agree that using laptops could be useful for formal learning (5). However, some are undecided, while others disagree. They indicated that laptops could make report writing, Internet surfing, notetaking, and accessing information simple, easy and fast (5).

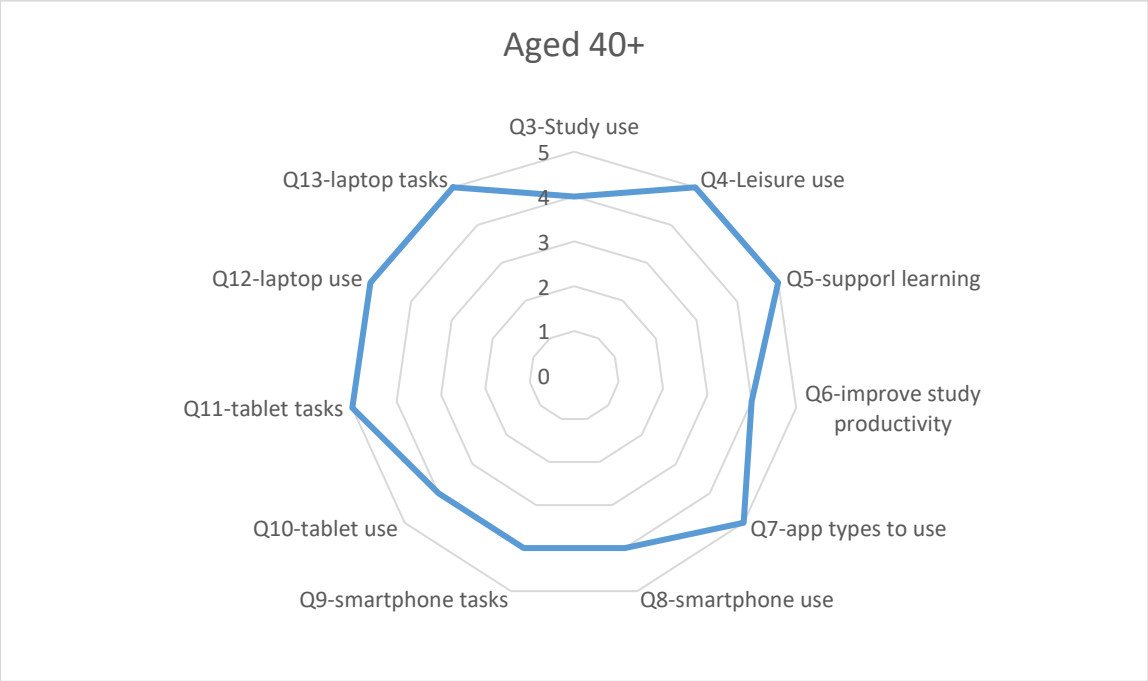


Figure 11. Radar chart of participants aged 40+

Figure 11 is a radar chart that shows answers of people aged 40+. A 5-point scale is used with (5) referring to positive and high values, (3) refers to middle and neutral values and (1) refers to negative and low values.

4.2.2 **Participant sub-group stories: Gender groups**

Most Male participants frequently use their mobile devices (phone, tablet, laptop) for formal studies (4), while others were not that much. However, they showed complete agreement that mobile devices are frequently used for leisure (playing games or listening to music) (5). They strongly agreed that mobile devices could support (5) and improve productivity for study (5). This group specified that any kind of app (tools, games, business, education, photography, social media, music, audio, health and fitness, and books and reference material) could be useful towards formal learning (5). Most males in this group are in agreement about the use of smartphones for learning (4). However, they did imply that accessing academic information and surfing the Internet is fast and easy using a smartphone (3). Furthermore, they also agree to the use of tablets for formal learning (4). There were indications that tablets could make surfing the Internet and accessing information simpler and faster (3). They undecidedly agree that laptops could be used for formal learning (5) and stated that laptops could make report writing and accessing information simple and faster (4).

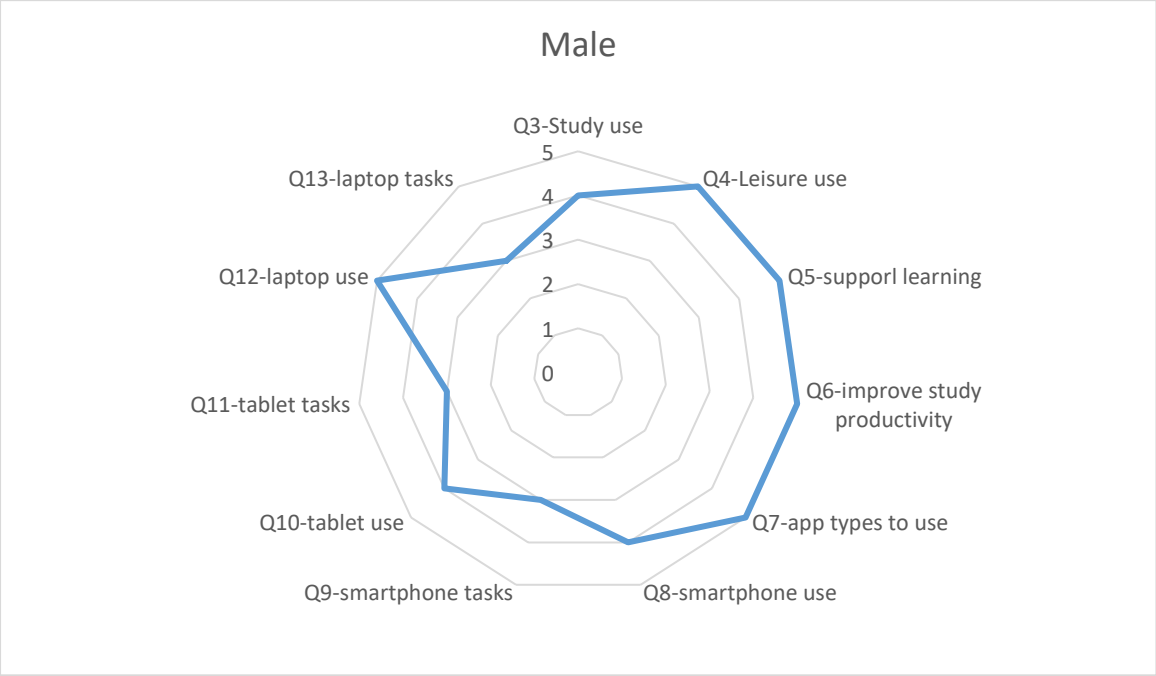


Figure 12. Participant sub-groups stories: Male

Figure 12 is a radar chart that shows answers of all male participants. A 5-point scale is used with (5) referring to positive and high values, (3) refers to middle and neutral values and (1) refers to negative and low values.

Many female participants use mobile devices (phone, tablet, laptop) frequently for formal learning (5). This group of participants frequently use their mobile devices for leisure purposes, such as social media and playing games (5). Many agree that mobile devices could improve study productivity (5) and support formal learning (4), This group stated that in their experience there are numerous types of apps (tools, games, business, education, photography, social media, music, audio, health and fitness, and books and reference material) that can be used for formal studying (5). Also, many of them in this group agreed that smartphones are used for formal learning (4), though, they did suggest that smartphones could make Internet surfing, taking notes and accessing academic information easier and faster (4). The majority of the group agree that tablets are used for formal learning (4), many female participants expressed that tablets could make tasks such as Internet surfing, report writing, note taking, and accessing information faster and easier (5). Similarly, the majority of female participants agree that laptops are used for formal learning (5). They mentioned that using laptops could make exploring the Internet, accessing academic information, note taking and report writing much easier and faster (5).

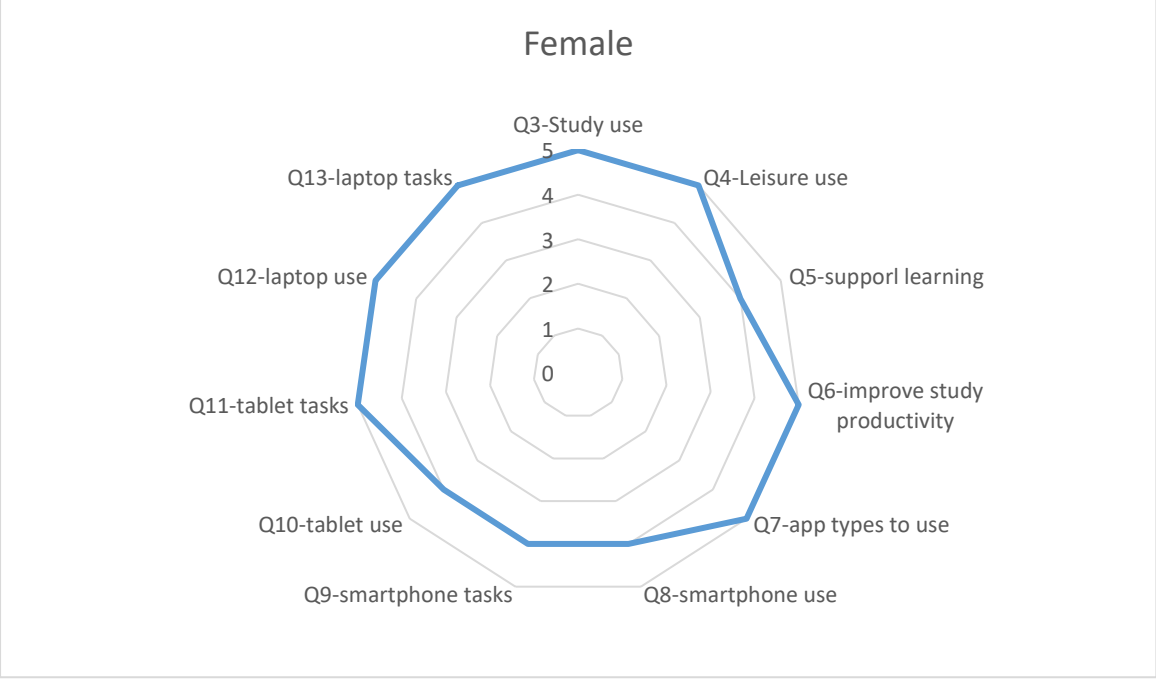


Figure 13. Participant sub-groups stories: Female

Figure 13 is a radar chart that shows answers of all female participants A 5-point scale is used with (5) referring to positive and high values, (3) refers to middle and neutral values and (1) refers to negative and low values.

4.2.3 **Participant sub-group stories: Gender and age groups**

Male participants aged 29-33 were neutral towards using mobile devices (phone, tablet, laptop) for formal studying (3). This group of participants do use mobile devices for leisure (playing games or listening to music) frequently (4). This group of participants agree that mobile devices can support (4) and improve formal learning productivity (5). They were also in agreement that regardless of the kind of apps used, be it tools, games, business, education, photography, social media, music, audio, health and fitness, and books and reference material, these apps can be used for formal learning (5). They were neutral about the use of smartphones for formal learning (3), yet despite being neutral, they stated that smartphones are suitable for making notetaking easier and faster as well as accessing information and Internet surfing faster and easier (4). However, this group showed different opinions about tablets being used for formal learning, as some agree with using tablets, while others disagreed using tablets for formal learning (3). Be that as it may, this group pointed out that using tablet can make notetaking and surfing the Internet simple and easy (3). This group agrees that laptops can be used for formal learning (4) and stated that laptops could make exploring the Internet, report writing and accessing information much faster and simpler (5).

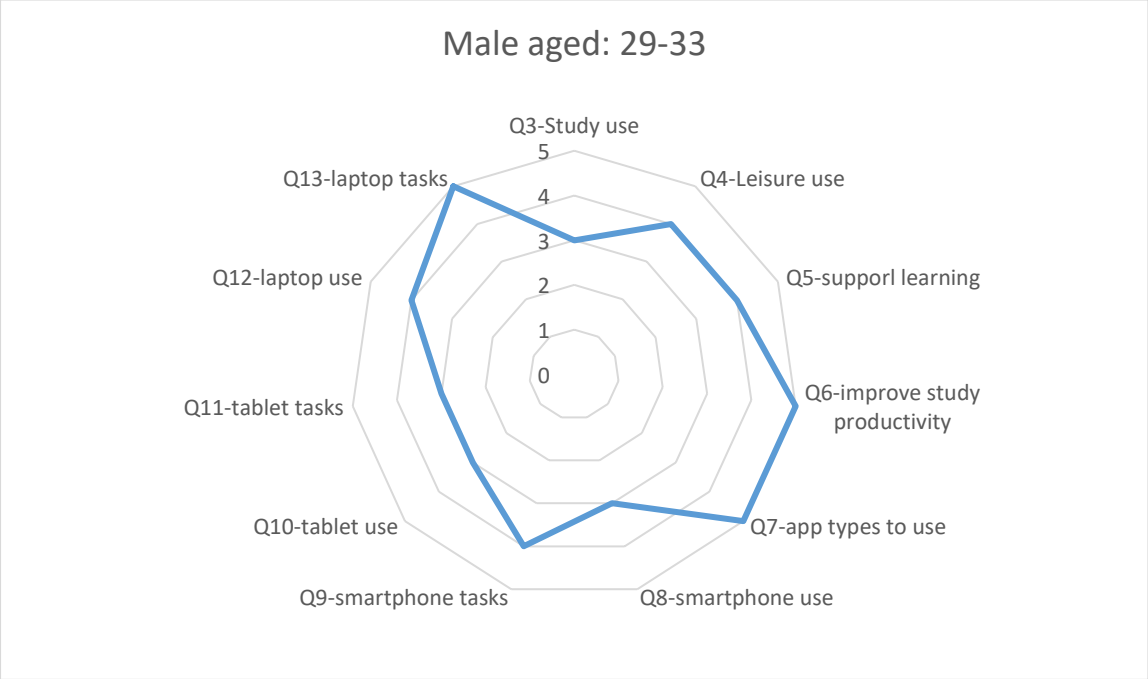


Figure 14. Participant sub-groups stories: Males aged 29-33

Presented in Figure 14, the radar shows answers from male participants aged 29-33. A 5-point scale is used with (5) referring to positive and high values, (3) refers to middle and neutral values and (1) refers to negative and low values.

Male participants aged 40+ use mobile devices (phones, tablets, laptops) for formal study purposes (4) as well as using their mobile devices for leisure (playing games or listening to music) (4). This group of participants agree that mobile devices can support (5) and improve formal learning productivity (5). They were all in unison in stating no matter what type the app was, tools, games, business, education, photography, social media, music, audio, health and fitness, or books and reference material, that it could be used for formal learning (5). This group agreed that smartphones are used for formal learning (4), and also agreed that with smartphones, activities such as accessing information and surfing the Internet could be faster and simpler (3). They agree that using tablets for formal studying (5) can be beneficial and that they can simplify information access and exploring the Internet (3). This group agree that laptops can be used for formal learning (5) and mostly agree that accessing information, report writing, taking notes (3) is more comfortable and faster using laptops.

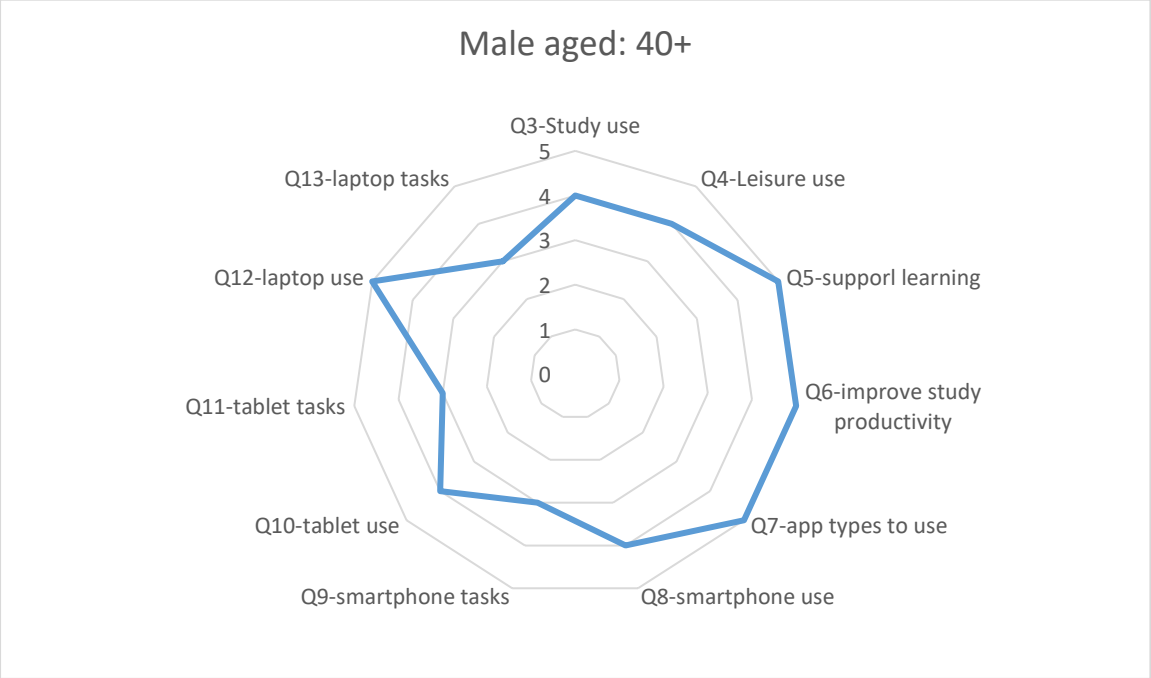


Figure 15. Participant sub-groups stories: Males aged 40+

Figure 15 shows answers of male participants aged 40+. A 5-point scale is used with (5) referring to positive and high values, (3) refers to middle and neutral values and (1) refers to negative and low values.

Female participants aged 29-33 use mobile devices (phone, tablet, laptop) very frequently for formal studies (5) and leisure (playing games, social media) (5). This group strongly agrees that these same devices could be used for formal learning (5) and could improve formal learning productivity (5). These participants communicated that different kinds of apps (tools, games, business, education, photography, social media, music, audio, health and fitness, and books and reference material) could be useful in formal studies (5). They ultimately agree that smartphones are used for formal learning (5) and also stated that smartphones could make accessing academic information, note taking and surfing the Internet more straightforward and faster (4). They also agree that tablets are used for formal learning (4) and that tablets could make taking notes and report writing as well as exploring on the Internet fast and more natural (4). They agree that laptops are used for formal learning (5) and suggested that laptops could make accessing information, report writing and surfing the Internet easier and faster (4).

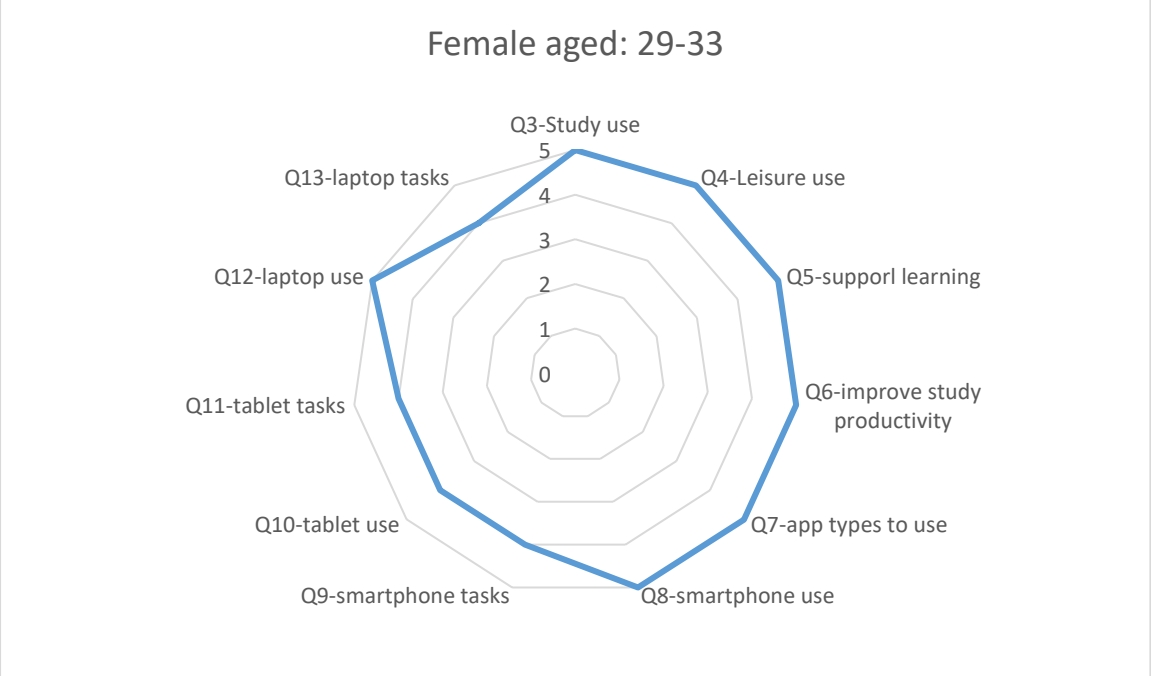


Figure 16. Participant sub-groups stories: Females aged 29-33

Figure 16 shows answers from female participants aged 29-33. A 5-point scale is used, as (5) refers to the highest values, (3) refers to middle values, (1) refers to the lowest values.

Female participants aged 34-39 use mobile devices (phone, tablet, laptop) very frequently for formal studies (5) and leisure activities (5). This group strongly agree that these same devices could be used for formal learning (5) and improve study productivity (5). They indicated that different kinds of apps (tools, games, business, education, photography, social media, music, audio, health and fitness, and books and reference material) could be used for formal studies (5). This group of female participants were in agreement that smartphone usage for formal learning is beneficial (4) and mentioned that smartphones could make taking notes and going on the Internet faster and easier (3). They also strongly agree that tablets are used for formal learning (5) and that tablets could make taking notes and report writing, as well as going on the Internet, fast and easier (4). They agree that laptops are used for formal learning (5) and suggested that laptops could make accessing information and report writing easier and faster (3).

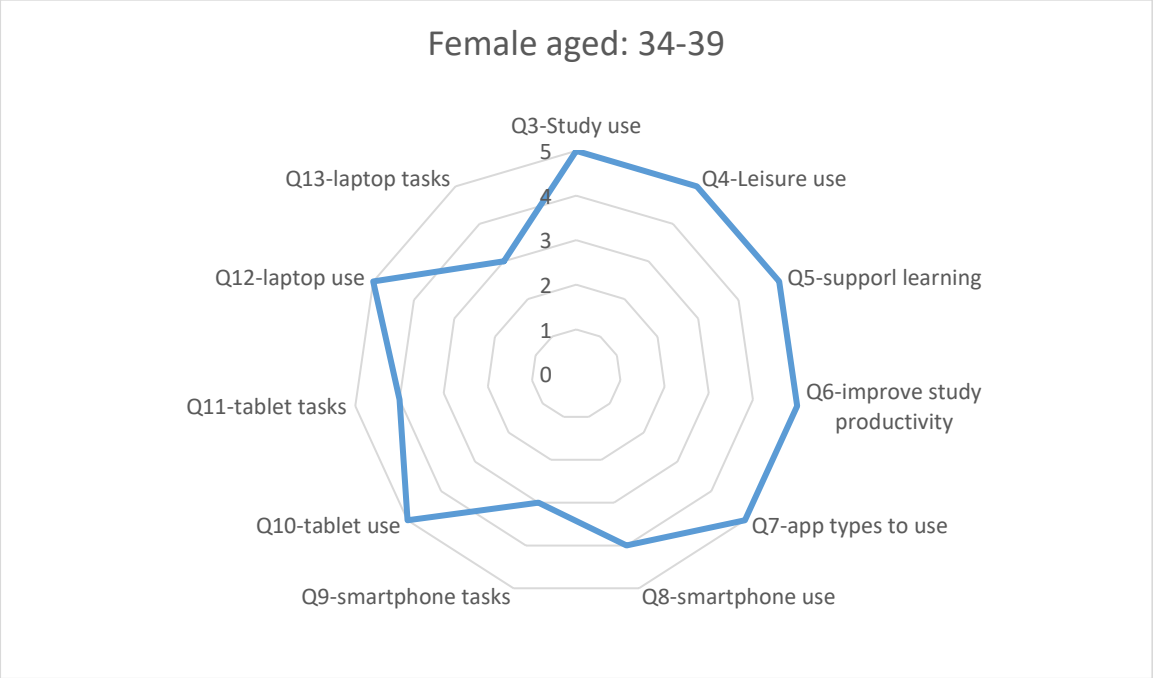


Figure 17. Participant sub-groups stories: Female aged 34-39

Figure 17 shows answers from female participants aged 34-39. A 5-point scale is used as (5) refers to the highest values, (3) refers to middle values, (1) refers to the lowest values.

Female participants aged 40+ reveal that many of them use mobile devices (phone, tablet, laptop) for formal studies and leisure (4), other participants admit to using their devices sometimes, and some admit to not using their devices at all for formal learning and leisure. The majority of this group agree that these devices could be used for formal learning and could increase study productivity (4). This group stated that different app type (tools, games, business, education, photography, social media, music, audio, health and fitness, and books and reference material) could be used in formal learning (5). Many participants of this group did show agreement of smartphones used for formal learning (4) and stated that using smartphones could make information access, notetaking and Internet surfing fast and straightforward (4). Many participants of this group agree that tablets are used for formal learning (4); some participants indicated that using tablets for formal studies can access information, notetaking, report writing and surf the Internet (5). They agree that laptops are used for formal learning (5), and they did suggest that laptops could make access to information, notetaking, report writing and surfing the Internet faster and a lot more straightforward (5).

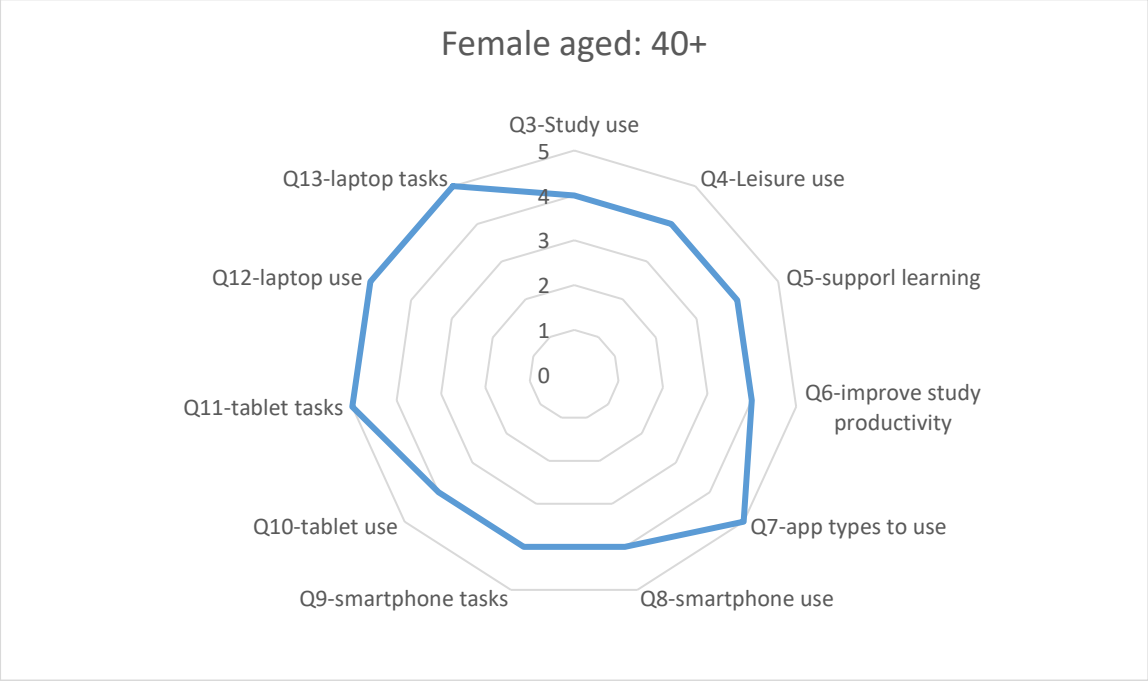


Figure 18. Participant sub-groups stories: Female participants aged 40+

Figure 18 illustrates the answers from female participants aged 34-39. A 5-point scale is used as (5) refers to the highest values, (3) refers to middle values, (1) refers to the lowest values.

5 Discussion

In the previous section, quantitative and qualitative analysis was applied to the data to find meaning where understanding was discovered. In this section, the author will interpret and explain the meaning behind the findings (of the literature and survey). The reason for the discussion is to share the author's interpretation of the results in light of what is previously understood and known about the research topic, along with explaining new forms of insight that have surfaced because of the research.

5.1 From the literature

From the heading of this section, a discussion is established from what the literature covers in light of the hypotheses/sub-questions. Figure 19 demonstrates what the literature addresses and mentions and its connection or association to the sub-questions of the research.

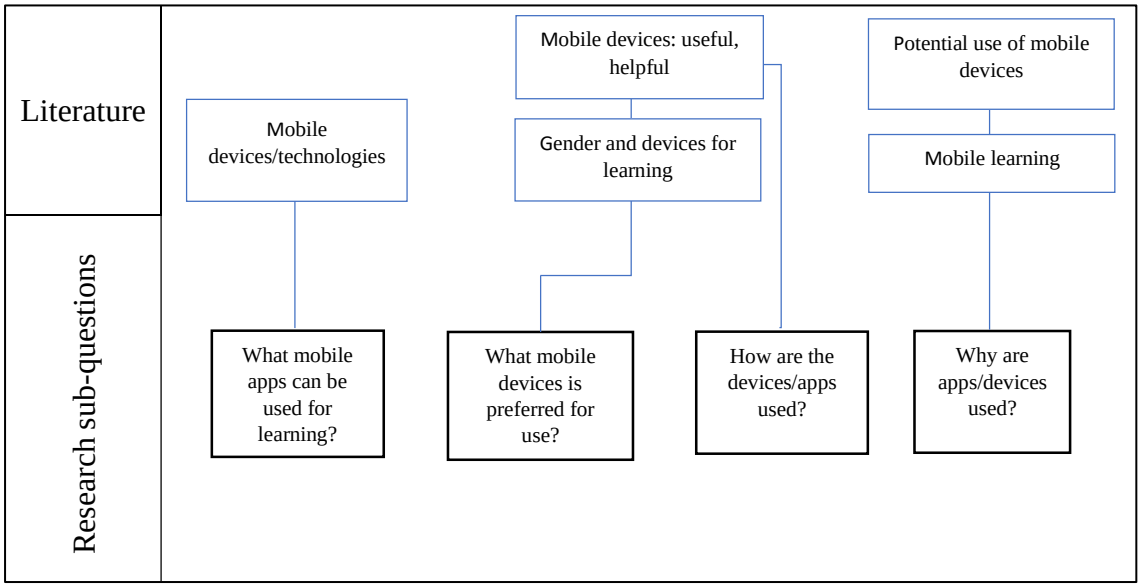


Figure 19. Literature and its relation to the sub-questions

5.1.1 Mobile devices/technologies

The literature shows that various researchers have similar ideas when mobile devices are described. The literature points out that mobile devices are wireless portable devices that can be used while the user is moving and that these devices are recognised in the following forms: laptops (notebooks, mini laptops, Chromebooks), smartphones (iPhones, touchscreen phones, android phones) and tablets (iPads, surfaces, notepads). These devices have in-built features

as well as various apps that can be used for formal learning, and various articles support the notion that many apps can be used for learning.

Al-Hunaiyyan et al. (2018) stated that social media apps are frequently used in learning. The social media apps that were identified are Twitter, Instagram, Facebook, YouTube, Snap Chat and LinkedIn. Bacca et al. (2014) looked into AR (augmented reality) type apps that can be used for formal learning.

Damyanov and Tsankov (2018) do specify apps like video apps, educational apps, and standard apps such as calculators as being beneficial to different learning environments. While Eppard et al. (2016) investigated apps that can be used for learning and language, and mentioned audio type apps such as SMS apps, as well as productivity, news, education, business and books, photos and videos, and entertainment, as commonly chosen apps for use during their research.

Balfagih (2017) researched the impacts of mobile devices with first-year students and stated that apps like SMS messaging and social media apps can be useful for formal learning. Johnston (2016) mentioned that apps such as Wikia, virtual worlds, gaming, communication cloud, social media, streaming apps, as well as assessment and information apps are confirmed to be used for formal learning. O'Connor and Andrews (2018) researched mobile devices and learning in clinical nursing education and found out that mobile apps such as calculators, dictionaries, reference guides were deemed extremely useful in this area of education.

Taleb and Sohrabi (2012) list a wide range and uses for apps that are valuable in different learning spaces. The lists consist of educational apps, dictionaries and referencing, communication and social media, audio apps, photos and videos.

Wai, Ng, Chiu, Ho, and Lo (2018) argued that students used apps for communication (WhatsApp, Line) and interaction (social media and email) purposes, searching for learning resources (journals, Moodle, digital libraries).

5.1.2 **Mobile devices: useful, helpful**

Literature reveals that there are many devices, especially mobile devices, available that can be suitable for individuals to use for formal learning. Also, many individuals prefer one device over another. Many works of literature revealed two mobile devices that are appropriate and acceptable and thus preferred devices by many users and learners. These devices were

smartphones and laptops. Al-Hunaiyyan et al. (2018) imply that the Apple smartphone known as the “iPhone” is the most commonly owned smartphone, and therefore, the most commonly used device for formal learning. Ali et al. (2017) show that smartphones were frequently used for study, which suggests that the smartphone is the preferred device selected for formal learning. Cromptona and Burke (2018) showed that smartphones were reported to be what students preferred — with tablets/iPads as the second choice, followed by PDA, audio players, and e-readers. O'Connor and Andrews (2018) imply that the smartphone or the "iPhone" is a preferred type of device used for studying, which supports what many others have already said.

Onaolapo and Oyewole (2018) show that many students use their smartphones for learning very often, on a week-to-week basis. Taleb and Sohrabi (2012) also pointed out in their research that smartphones were frequently used for academic study.

Balfagih (2017) goes on to elaborate that due to students relying more on laptops for academic work than other mobile devices in their possession, Balfagih claims that the preferred mobile devices for academic work are laptops. In their research, Davison and Argyriou (2016) claimed that the preferred device is laptops, followed by smartphones and then tablets. Be that as it may, the device preference for both genders is laptops. Fojtik (2017) states that the most common devices used for formal learning are laptops and tablets. Klimova and Poulova (2016) studies imply that notebooks (which is another name for laptops) are mostly used by individuals, compared to other listed devices in their study. Kopáčková (2014) shares that notebooks are the primary devices to use for academic learning. This came out due to the results of the study indicating that students used laptops more often than other mobile devices within their work.

5.1.3 **Gender and mobile devices**

Adding an extra element such as gender to a study also gives an extra layer of detail to help identify which devices are deemed more appropriate for use for formal learning. The findings produced by Davison and Argyriou (2016) revealed that laptops are the favourable choice between genders when mobile devices are used for formal learning, yet males were more open and more acceptable to using tablets. Adedoja and Morakinyo (2016) did a study on gender influence on undergraduates’ acceptance of mobile learning and implied that when using mobile devices, there is no variation or contrast between male and female. They also

stated that females adopted and utilised mobile devices for mobile learning due to the ability to use them at any time and the ease of accessibility to varied resources and content.

5.1.4 The use of mobile devices

The use of mobile devices and the tasks that these devices can potentially influence the way in which people learn is great. Some instances explain the capabilities of these devices, which in turn influence the mental state and attitudes of users, which in turn results in a positive attitude and emotion towards the use of devices, and fundamentally, the topic or area they are learning about. Literature shared views and reasons why devices and apps are used by individuals.

Bacca et al. (2014) mentioned that VR and AR devices are useful for more exceptional learning performance, which leads to motivation to learn more, that creates a positive attitude towards the use of devices for learning.

Kumar and Mohite (2018) said that mobile devices could improve and advance the learning experience and performance of students. Also, devices can decrease and remove geographical barriers as learning can occur per the student's choice, as well as improving the efficiency of communication between peers and faculties. Dundar & Akcayir (2012) says that learning can be made portable and not be limited to a lecture hall and individuals can access and learn anywhere, at any time. Furthermore, the use of AR and VR can create a learning environment that is not usually accessible to some individuals due to geographical, physical or financial constraints.

Dunleavy et al. (2019) found that formal learning with devices is as active as traditional methods of learning, and Evrim (2014) elaborates on this notion that devices offer the individuals the ability to work on all forms of documents and files in relation to learning at any time, from any location. Ferial et al. (2016) mentioned that devices improve creative and critical thinking, with collaborations and engagement among students. Tasks and activities associated with formal learning can be performed and accomplished at any time within a given timeframe. Fojtik (2015) says that using mobile devices allows the user to interact with their devices on another level, such as drawing diagrams, taking notes, and/or handling assignments.

Hamidi and Chavoshi (2018) say that individuals can learn anywhere and anytime using mobile devices, furthermore, using devices allow students to collaborate and share their ideas and concepts with the development of the Internet. Also noted is that an important reason or

factor that devices are used is due to its multitasking nature; as mobile devices are fitted with varied features and functions such as video recording, Bluetooth, SMS, MMS and other educational tools. Hashim et al. (2015) wrote about the personalisation and customisation that devices provide for formal learning, such as adjusting the font size, prioritising timetables, altering the interface and other customisation activities to ease learning. Kim and Park (2019) found that learning with devices has positively affected nursing students in terms of skill, understanding, attitude and performance in learning, and pointed out that using devices may be more effective than learning without devices.

Miller and Cuevas (2017) shed light on devices and learning, and the findings show that using devices when learning can have effects on one's attitude and motivation, which may lead to students being more eager to learn. Saleh & Bhat (2015) says that when learning with devices, it can result in positive outcomes. Wu et al. (2012) shared that with the ever-changing nature of technology and mobile devices, it allows devices to be more available and resourceful, which can, over some time, increase the use of devices for formal learning. Zhang et al. (2013) mentioned multitasking with devices and how it gives a powerful and positive intention to individuals who use devices for learning.

5.1.5 Mobile devices and learning

Mobile devices and learning do offer many reasons for mobile devices and learning in collaboration, as many kinds of literature look into mobile devices and learning as a beneficial combination.

Al-Hunaiyyan et al. (2018) stated that devices are seen as learning tools as it provides freedom to learn and study at the pace of the student. Also, freedom to learn is possible because of the features and functions that are installed on the devices. Bacca et al. (2014) reported that since reality devices or technologies such as VR are more readily available now, VR could provide individuals full immersion in the learning and allow more practical experiences.

Eppard et al. (2016) describe an example of how using built-in functions such as SMS messaging can aid individuals with linguistic studies in terms of structure and grammar. The audio functions of mobile devices can assist individuals with diction and speech patterns. Evrim (2014) mentioned that devices could be used as a tool to explore real-world mathematics, conduct scientific research and investigation, engage in a language learning context, which would in turn enhance professional learning. Farley et al. (2015) research

commented that devices are used as a learning tool; as it allows students to access information, collaborate with others, and to stay in contact with individuals and staff.

Hamdani (2013) suggests that devices are used as tools for delivering learning and educational materials. These resources included, but are not limited to, dictionaries for vocabulary increase, to translate from one language to another, spell and grammar checker, and/or group formation. Haßler et al. (2016) stated that mobile devices are used as cameras to take pictures, devices can be used as educational tools, such as dictionaries and readers.

Mtega et al. (2012) posits that students use their devices as a repository to store, manage and retrieve information such as e-books, instructional materials, reviewing grades, and furthermore, the article also comments on devices being used as timetables for appointing meetings, confirming due dates, as well as being dated with information for room change.

Munday, (2016) research reveals that mobile devices are used more towards mobile assisted language learning in which the devices use its built-in communication functions such as text messaging, voice capturing to learn another language or improve on diction, language structure.

Pimmer et al. (2016) shared about how devices can be used to support and aid the construction, co-construction and sharing knowledge via linguistic representation such as written and oral speech, or visual guides such as images and videos.

Taleb & Sohrabi, (2012) studies reveal individuals using their devices as simple communication devices via voice, text, video and multimedia. Vázquez-Cano (2014) describes that students using their devices as simple educational tools such as dictionaries, reference guides, a word processor for note taking and other forms of use that are described as educational. Zydney and Warner (2016) research showed that science students use their devices as sketchbooks to create and enhance images, using different productivity apps for note taking, as well as being used for management purposes such as managing assignments, appointments and knowledge sharing.

5.2 From the survey answers: Quantitative results

A discussion from the quantitative analysis is established to aid the author in understanding the meaning behind the analysed data. Figure 20 shows the quantitative results and their connection to the sub questions.

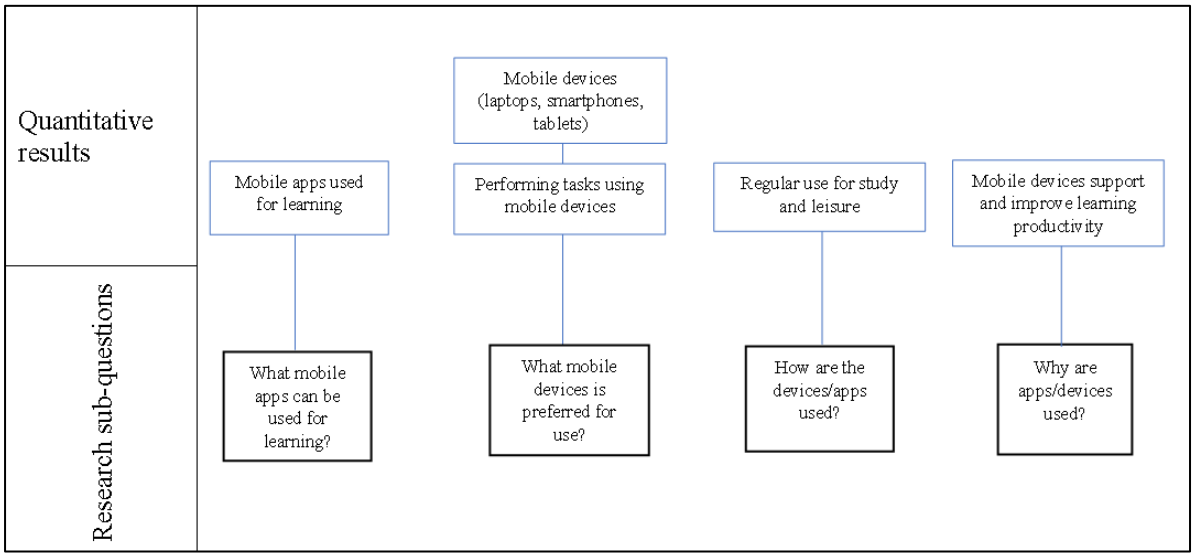


Figure 20. Quantitative results and its relation to the sub questions of the research

5.2.1 Mobile apps used for learning

The analysed data is based on responses from Question 7 that questions participants on the types of apps that are considered to be used for learning. The author concludes that various apps are used by individuals while learning, with Education, Books and reference, and Tools being the most popular apps (see Table 23).

However, there are changes when gender responses are analysed. Table 24 confirms that the top three apps for female usage are Education, Books and references, and Tools as expected, yet the top three apps for male usage are Tools, Education along with Music and audio.

Books and references, Tools and Education apps were expected; however, Music and audio app types were not expected as apps used by individuals for learning, and thus surprised the author.

While analysing the data from female age groups, the author noticed that females aged between 24 and 33 have agreed that all forms of apps are used for formal learning, to which the author concluded that female individuals aged 24 through to 33 use all kinds of useful and

varied apps available to help them with learning in all areas. Alternatively, the answers to the survey are rushed and thus may not reflect the real experience of the participants. Females aged 34-39, showed apps are used for learning, though not all of them use the same type of apps for learning, which is to be expected. However, 100% of females aged 34-39 agree that Music and audio apps are useful for learning. The author understands that there ought to be a correlation between Music and audio and females learning. Table 25 confirms that Music and audio has a connection with learning as 100% of females in the various age ranges (24-28, 29-33 and 34-39) totally used such apps for formal learning. Additionally, the author was surprised to see females aged 40+ agreeing to utilise a wide array of apps should they be formal learning.

The author can conclude that, based on the responses from the participants, when males are formal learning, they use apps to help with their learning. Also, 100% of males aged 29-33 and 75% aged 40+ support the idea that Music and audio can be used for formal learning (see Table 26). Based on the information, the author concludes that there is a beneficial link between Music and audio and formal learning.

5.2.2 **Mobile devices (laptops, smartphones, tablets)**

Mobile devices are explanatory as it refers to mobile devices as described in the heading. The findings were based on the analysis of Question 8 referring to smartphones, Question 10 referring tablets and Question 12 referring to laptops.

The smartphone is a suitable and useful device to be used for learning and studying. That is confirmed based on the fact that 65% of individuals from this study agree and support that notion. However, the data reveals that 26% are impartial to using smartphones with a smaller group of people disagreeing with smartphones being used for formal learning (see Table 45)

In comparison between genders, Table 46 confirms that 68% of females who are learning or studying use their smartphones, while 50% of males learning or studying use their smartphones.

When extra variables are added such as gender and age, the author noticed that females in the following age groups: 29-33, 34-39 concur that smartphones are used for studying, and thus are applicable devices or tools for formal learning. While most females aged 40+ do use their smartphones for learning, not all females in this age bracket felt the same. However, the younger age group 24-28 signified a neutral standpoint along with females aged 40+ (see

Table 47). Therefore, a conclusion can be made that females use smartphones should they learn formally, although younger and older females tend to be neutral on the matter. Whilst females aged 29-39 feel more strongly towards the use of smartphones for formal learning.

Table 48 confirms that most males aged 40+ find smartphones are suitable devices for formal learning. However, the author is surprised to note that younger males aged 29-33 are disinterested and disagreed that using their smartphones for formal learning was beneficial.

In terms of using a tablet for formal learning, participants in this study generally agree that they are also suitable for formal learning, as approximately 80% agree with using tablets in these contexts (see Table 49).

The author is surprised yet again that females aged 24-28 are neutral on tablets being used for formal learning. For females aged 29-33, they tend to agree that tablets are appropriate devices to be used when learning. However, females aged 34-39 strongly agree with tablets being used for formal learning, and therefore, tablets are the preferred and ideal device for them (see Table 51).

The author noticed that males also feel quite positively towards tablets, deeming them suitable for male learners, as 83% of males use tablets for formal learning. However, the author also noticed that 16.67% strongly disagree with using tablets in these contexts. Be that as it may, what was not expected were males aged 29-33 indicating strong disagreement with using tablets. Based on that, the author can surmise that tablets are somewhat applicable for males to use and that males aged 29-33 may not have a tablet to work with when formal learning, or that based on the collected data, there is no need for tablets in formal learning environments (see Table 52).

Laptops are fitting for learning, considering there are high responses on laptops being appropriate (see Table 53). When an extra component such as gender is added, the author can confirm that laptops are used for learning and that laptops are the preference for both genders for formal learning. However, laptops are not perfect as there are indications of disagreement and being neutral to which surprised the author (see Table 54).

Based on the data, females aged 24-28 neither agree nor disagree with laptops being a favoured mobile device for formal learning, hence a neutral response towards the use of laptops for learning. This age group have pointed out their neutral stance for using mobile

devices to learn. The author concludes that females in this age group do not consciously use mobile devices for formal learning.

Females aged 40+ feel more strongly towards the use of laptops over other devices such as smartphones and tablets as tools to support formal learning. This is supported by females aged 33-39, as they have similar, if not identical, responses to the females aged 40+, and have concluded that they too do not worry about what devices are used for learning as long as they are learning.

5.2.3 Performing tasks using mobile devices

From the heading of this section, the discussion is on the tasks that can be performed on devices (smartphones, tablet and laptops). The data confirms that both females and males in this study perform multiple tasks simultaneously with mobile devices.

When formal learning is considered, there are universal tasks that can be accomplished with any mobile device, be it a smartphone, laptop or tablet. These tasks can be performed side-by-side, in parallel, allowing the user to perform multiple tasks at the same time.

When smartphones are selected and used for formal learning, the most common task is to surf the Internet. Additionally, the data states that females aged 24-33 are likely to perform two tasks simultaneously. Females aged 29-33 perform at least three tasks simultaneously, while females 40+ are more likely to perform at least one task at a time. The author did not anticipate females aged 40+ to multitask using their devices (see Table 30). Males do perform at least one task and have indicated of performing four tasks. Yet males aged 40+ show more competence in using their devices because the data shows that they can perform at least one task to four tasks and when compared with the younger males aged 29-33 suggests that a maximum of three tasks can be performed. Seeing males aged 40+ indicating of performing more tasks than males aged 20-33 is shocking since the younger males are young enough to have been brought up with these kinds of technology, while older males may not have such exposure with mobile devices. Be that as it may, the author does consider the existence of a technology or digital divide (see Table 32).

When tablets are involved, the common task associated with this device is surfing the Internet. The data shows different results in the interaction with tablets and individuals, as females aged 24-28 performs three tasks, females aged 29-33 a minimum of three, females aged 34-39 four tasks and above. However, females 40+ still at the very least, are performing

one task at a time (see Table 36). Nevertheless, the results are similar for males in the sense that the data states that males perform a minimum of one task at a time on tablet-like mobile devices (see Table 38).

According to the data, the primary and frequent task performed on laptops was accessing academic information, which surprised the author. The author was surprised because he had expected that tasks such as writing reports or scribing notes would be performed more often than tasks like accessing academic information, since using laptops to write will help ease the writing and formatting process while accessing academic information can be easily completed using any mobile device. In saying that, the data confirms that multitasking is popular while using laptops, and females aged 24-28 perform (all) four tasks. While females aged 29-33 perform at least three tasks, females 34-39 perform at least two tasks and females aged 40+ the same with a minimum of one task at a time while utilising laptop devices. Yet, males show signs of multitasking as well, with younger males aged 29-33 able to perform at least three tasks simultaneously while using laptop devices. However, what the author was not expecting was a50-50 split with males aged 40+. The data shows that 50% of males aged 40+ manage to perform one task at a time on laptops, while the other 50% affirmed that four tasks are regularly performed at the same time on laptops by this age group.

5.2.4 **Regular use of mobile devices**

Mobile devices, according to participants, are used for formal learning regularly. The data reveals that over half of the study participants have used or are currently using their mobile devices (laptops, tablets, smartphones) for formal learning purposes on a regular occurrence, and the author sees that there are participants who do not utilise their devices for study purposes. Thus, the author comments that these participants must use their devices for other means, such as leisure purposes. (see Table 7).

When looking into the answers per gender, their responses reveal that two-thirds of the female participants are open to formal learning using their devices (laptops, smartphones, tablets). Their responses indicate that their devices are used very frequently or frequently in this context. Though the responses from male participants are much smaller, there is an indication that males are also opened to using their devices as they learn formally, since more than 80% of males have indicated using their devices regularly for formal learning (see Table 8).

The majority of females do support the notion of using devices (laptops, smartphones, tablet) to learn formally. Though some females aged 40+ have suggested that they do not use their devices. The author has considered that these few individuals may have no need, or desire, to study. As the 40+ age group does not specify an upper age limit, these individuals may be in their 50's, 60's or 70's, which could be a reason for not using mobile devices for formal learning. With that in mind, and assuming they undertook formal education, such devices (laptops, tablet, smartphones) may not have been available, or existed, during their younger years (see Table 9).

Based on Table 10, the author concludes that the majority of male individuals have studied or are currently studying, using mobile devices (laptops, tablet, smartphones) as tools to aid them in their studies. However, the author thinks that the minority may not be interested in formal studies, and thus have indicated this by selecting 'not that much' as a response to survey questions. Furthermore, such individuals would no doubt use their device/s for other purposes.

Based on the findings, a conclusion is formed by the author, that mobile devices (laptops, tablets, smartphones) are used more for leisure purposes, than for study purposes, which is expected. (see Table 11).

Based on the data presented, the author has determined that both female and male participants use their devices for leisure activities such as playing games, exploring Youtube, chatting with friends via social media and other activities. The author did not expect a small percentage of female and male respondents to indicate that they sometimes use their devices for leisure, or that they do not use their devices that much as much for leisure purposes. The data shows that there are people who do not use their devices for leisure purposes or for learning, the author must wonder, what purpose do these people use their devices (see Table 12).

The data gathered shows the regular use of mobile devices for non-formal learning and leisure activities based on responses from female age groups. What is interesting is that all females from the following age groups 24-28, 29-33, and 34-39 all stated that they frequently use their devices for leisure. The author concluded that leisure activities, such as playing games or listening to music, could positively influence these individuals. Furthermore, the author noticed that there are females aged 40+ who do not use their devices often, which may imply that these individuals may use their devices for learning or work-related activities (see

Table 13). When analysing Table 14, the author concludes that males aged 29-33 enjoy using their devices for leisure, while most of males 40+ also use their devices for entertainment.

5.2.5 **Mobile devices support and improve**

95% of participants in this study indicated that using mobile devices is useful to support formal learning, yet the remaining 5% stated that they are neutral on devices being used to support formal learning. The author understands that the remaining 5% has no interest in using devices to support their learning and studying and yet, most individuals are willing to use their devices for support should they be learning and studying formally (see Table 15).

Both genders show signs of using mobile devices to support learning. However, when looking into the female and male age groups, things capture the interest of the author, such as females aged 24-28 and female aged 34-39 having all stated that mobile devices are used for formal learning. This leads the author to conclude that these groups of females are currently students, or they enjoy learning (see Table 17).

Males are also using their devices for supporting their learning.

However, there is a change of pace when questioned on mobile devices being used for improving formal study productivity. All males strongly agree that improving study productivity can be accomplished using mobile devices, yet there is a range of female opinion, with 8.57% being neutral, and 2.86% disagreeing with the notion, yet approximately 90% of females agree that mobile devices improve on the productivity of formal learning (see Table 20).

Females aged 34-39 strongly agree that using mobile devices can improve study productivity. Furthermore, they are also in one accord on devices being used to support learning. The author concludes based on the findings that these induvial have been students and experienced study productivity increase and improvements whilst using mobile devices. While females aged 24-28 are neutral on this matter it makes it difficult for the author to draw any conclusions on the feelings or attitudes females aged 24-28 have on the use of mobile devices to improve study productivity (see Table 21).

5.2.6 **Demographic results: age and gender**

Demographic results refer to questions on age and gender based on the analysed data in the previous section. The findings from the data conclude that there were 41 responses to the survey. Of these, 35 responses were from participants who identified themselves as females,

while the remaining six responses originated from participants who identified themselves as males. These participants were varied in age. The youngest participant was between the age of 24 years and 28 years, along with the older participants who are aged 40 and over.

The topic of the survey appealed more towards female participants, than it was towards male participants, as there were more female respondents than male respondents. Furthermore, it appears to the author that the senior or older (40+) participants must enjoy surveys since the largest group of participants from both genders are aged 40 or over.

Survey bias is when respondents in one particular demographic outnumber the respondents in another demographic. In this study, there is a bias of gender due to one gender (female) outweighing the other gender (male), as well as an age bias where one age group outnumbered another age group. Therefore, with a total of 41 responses from the survey, approximately 85% of respondents were female, and about 15% being male respondents. In terms of the age-based bias, of the 41 respondents, 2% were aged 24-28, 12% were aged 29-33, 10% were aged 34-39, and 76% were aged 40+. These percentages show a greater bias towards those 40 years old and over.

5.3 From the survey answers: Qualitative results

The qualitative results are discussed to find conclusions for the research questions

Table 57.

Comparing female and male participant sub-group stories

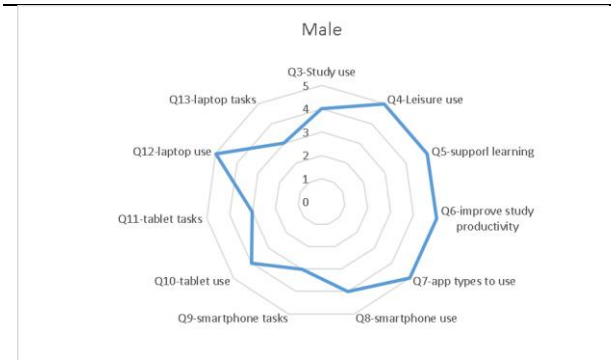
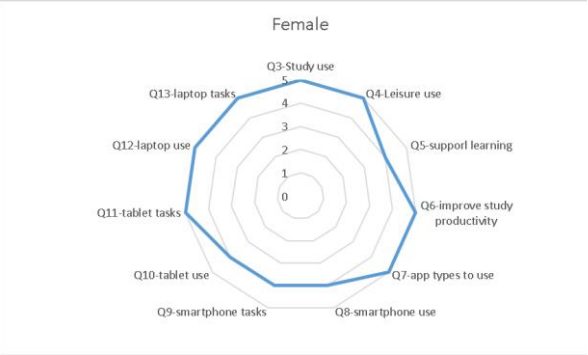
Male radar	Female radar
	

Table 57 display two radar charts that help visualise the answers from female and male participants of the survey. Thirteen variables represent each question of the survey, with scales from 0 (being the least minimum value) – 5 (being the highest, maximum value).

There are signs that females and males have similar notions towards the use of devices (smartphones, tablets, laptops) for formal learning. They also identically indicate the use of devices for leisure purposes, such as playing mobile games and watching videos. They have shown agreement in the fact that using devices can aid and support individuals in formal learning, as well as improving learning productivity of individuals. Their opinions towards apps and the kinds of apps that can be used for learning for both females and males have implied that apps such as tools, games, business, education, photography, social media, music, audio, health and fitness, and books and reference are suitable for learning. Both female and male participants share the same idea on smartphone use for study and learning in formal contexts, as well as laptops and tablets for learning in these environments.

However, there are elements in these radar charts that indicate that there are gender differences in terms of responses. A good example here is the difference in opinion on whether devices should be used for supporting learning. Males wholeheartedly approve of devices for learning support, while females do display some hesitance.

Furthermore, literature shows that devices are capable of various tasks and do ease the stress that is associated with formal learning. However, there is a difference in an opinion supporting the use of devices to perform tasks. Males show some form of uncertainty to perform tasks using smartphones, tablet and laptops. They also indicated that these devices are not capable of performing all tasks. Nevertheless, the author does notice that females are certain that using tablets and laptops to perform tasks can be possible and that all tasks can be performed, though preferably, with smartphones.

The author noticed other things between the radars:

- **Stability:** There appears to be more stability from the female radar than that of the male radar. The radar is more circular and rounder covering a full area, yet there is a consistency with the male radars when prompting about tasks performed on laptops, tablets and smartphones.

- **Usefulness of devices:** per the authors understanding of the radars, the author notices the males might not see these devices (smartphones, laptops, tablets) as useful due to their uncertainty of devices performing tasks that can make learning easier, faster, which in turn can increase learning productivity that results in supporting formal learning. Tasks such as accessing academic information, composing reports can be completed using apps made available via an app store. However, the females see devices as helpful and useful since they agree that tasks can be performed and accomplished using devices such as laptops, smartphones and tablets.

- **Devices easy to use:** as commented earlier, both genders shared the same idea for using smartphones, laptops and tablets for learning. The author believes that since the females confirmed using devices for leisure and study more frequently, that implies that they are familiar with the setup and interface of their devices, which makes using their devices easier. Be that as it may, the males have indicated that devices are used more for leisure. The author thinks that this could be the reason why males show uncertainty towards devices being used for completing tasks such as exploring the Internet, accessing academic information, composing reports and other formal learning tasks,

- **Multi-device use for learning:** The radars reveal the use of many devices for formal learning. Both female and male participants share identical views on the use of devices (laptops, smartphones, tablets) for formal learning.

- **Multitasking on devices:** the survey lists specific tasks that are related to formal learning, and these tasks can be performed using mobile devices. The radars reveal that both female and male participants perform at least two tasks at the same time. Furthermore, the radars also show two factors for multitasking: a level of skill required for device use and types of devices. The female radar shows tasks performed on laptops and tasks performed on tablets are at the highest end of the scales, indicating that females may have a higher level of skill to use mobile devices. Yet when compared to male responses, the author notices that tasks performed on laptops, on tablets and smartphones are much lower for males, and therefore, the skill level of male participants for multitasking could be lower than female skills for using mobile devices.

6 Conclusion

The author concludes the findings from this research and provides an answer to the questions of the research, as well as stating the constraints and limitations that occurred during the research. Furthermore, based on the experience, the author states areas that may need refinements and a reflection on the research process, as well as potential areas to extend and further the research.

In the research, the idea of mobile devices and its influence and effects on formal learning was explored with four hypotheses in mind to prove and validate. From the literature, there were numerous trends, and from the online survey using quantitative and qualitative data analysis, trends were discovered. However, during the data analysis, the hypotheses of the research could not be evaluated or proven due to lack of significant statistics, which is a result of not reaching the targeted sample size with the survey. Therefore, the proposed hypotheses were converted into the sub-questions.

In this research, trends and themes were discovered to answer the sub-questions, which in turn could answer the main research question, giving more understanding to the effectiveness of mobile devices when utilised for formal learning.

The main research question is: What elements can affect people learning when using mobile devices? The findings from the research can be applied to answer the main research question by answering the sub-questions.

To find elements that cause influence, the main question was divided into four sub-questions:

1. What mobile apps can be used for learning?
2. How are devices used for learning?
3. Why are apps/devices used for learning?
4. What mobile devices are preferred for use when learning?

To find answers to these questions, the author analysed information from the literature and results from the survey. The TAM model was used to bridge the understanding between what the literature states and what the survey results state (see Figure 21). The TAM model has four concepts:

1. Perceived usefulness
2. Perceived ease of use

3. Attitude
4. Behavioural intention to use

Perceived usefulness refers to its' usefulness and helpfulness. Ease of use refers to the easiness of operating devices and completing tasks. There are two forms of attitude in the context of the research: positive attitude and negative attitude, which are by-products of Perceived ease of use and usefulness. From there, the attitude towards the use of devices will effectively influence the behavioural intent to use.

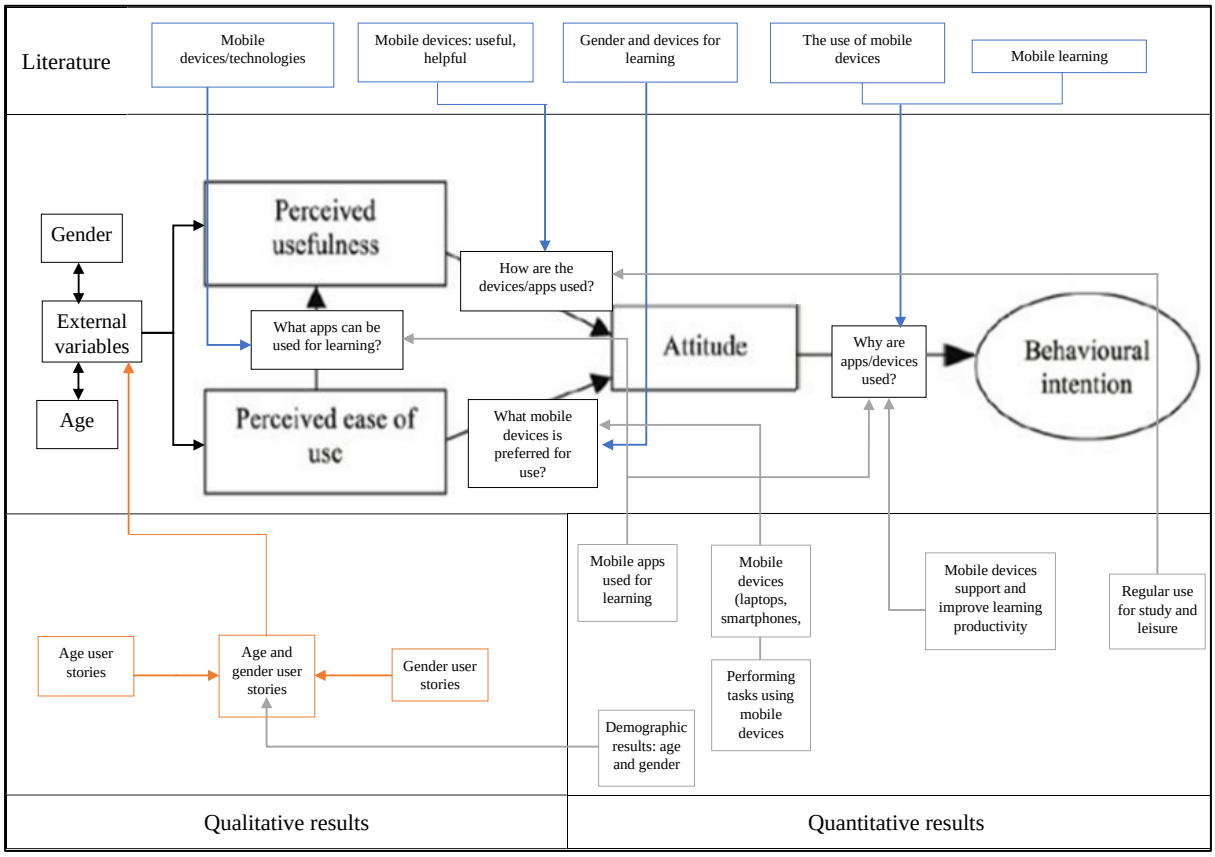


Figure 21.Literature review and analysis of survey results in light of the TAM model

Figure 21 depicts the literature, the quantitative and the qualitative results using the TAM model as a bridge to provide an answer to the questions.

What app(s) can be used for learning?

Data shows, from both the literature and survey, that apps can be used for learning and that there are multiple apps available that can be useful and that can be simple to use for formal learning. However, the literature reveals that the most common apps that individuals use are

Education apps and Communication-related apps. However, the author has not discovered literature that addresses gender and age regarding the kinds of apps that are used. Current literature suggests that individuals and their collections of apps are used individually and not used concurrently.

The survey revealed that many apps could also be used for learning, as indicated by participants, with Tools, Education and Books and references being mostly used and seen as useful. However, when adding gender preference, the results slightly change. Females have indicated that using Tools, Education, and Books and references apps while they study is most beneficial, yet males have shown that they too use Tools and Education apps, along with Music and audio apps as well.

What separates the results from the survey to that of the literature is that the literature the author has read did not cover or address using multiple apps concurrently. Nevertheless, the findings of the survey suggest that individuals use many apps, to which the author can conclude that many apps are used concurrently. Table 58 and Table 59 displays interesting findings in terms of the number of apps that are used for learning.

Table 58.

Multi-apps used according to the female age groups

	18-23	24-28	29-33	34-39	40+
One app	0.00%	0.00%	0.00%	0.00%	**3.70%**
Two apps	0.00%	0.00%	0.00%	0.00%	**3.70%**
Three apps	0.00%	0.00%	0.00%	0.00%	**11.11%**
Four apps	0.00%	0.00%	0.00%	**25.00%**	**3.70%**
Five apps	0.00%	0.00%	0.00%	0.00%	**7.40%**
Six apps	0.00%	0.00%	0.00%	0.00%	**18.51%**
Seven apps	0.00%	0.00%	0.00%	**25.00%**	**14.81%**
Eight apps	0.00%	0.00%	0.00%	0.00%	**11.11%**
Nine apps	0.00%	0.00%	0.00%	0.00%	**7.40%**
Ten apps	0.00%	**100.00%**	**100.00%**	**50.00%**	**18.81%**

Table 59.

Multi-apps used according to the male age groups

	18-23	24-28	29-33	34-39	40+
One app	0.00%	0.00%	0.00%	0.00%	0.00%
Two apps	0.00%	0.00%	0.00%	0.00%	0.00%
Three apps	0.00%	0.00%	0.00%	0.00%	0.00%
Four apps	0.00%	0.00%	0.00%	**25.00%**	0.00%
Five apps	0.00%	0.00%	**50.00%**	0.00%	**25.00%**
Six apps	0.00%	0.00%	0.00%	0.00%	**25.00%**
Seven apps	0.00%	0.00%	**50.00%**	**25.00%**	**25.00%**
Eight apps	0.00%	0.00%	0.00%	0.00%	0.00%
Nine apps	0.00%	0.00%	0.00%	0.00%	0.00%
Ten apps	0.00%	0.00%	0.00%	0.00%	**25.00%**

The notion of apps being used for learning purposes, for formal learning is supported by the collected and analysed data derived from the literature and the survey results. Furthermore, results show that many apps can be used at one time. The author can conclude that many apps are used simultaneously by the research participants.

What device is preferred for formal learning use?

The previous question explored the use of apps and determine what kind of apps are considered and used for formal learning and so, to expand the current question, it asks what device(s) would mostly be used to access and operate these types of apps.

The data reveals that there is a preference of devices, of mobile devices for specific reasons, purposes, tasks and activities.

The literature shared that laptops and smartphones are typical and are the preferred choice for learning. Smartphones are preferred due to many people owning smartphones, as works of literature have stated that smartphones are ubiquitous. Laptops are liked by individuals because many formal learning settings utilise desktops and laptops can create identical environments.

Additionally, when looking into the gender preference of mobile devices to be used for formal learning, the results show that females and males prefer laptops. However, upon further examination, when adding other variables such as ages, gender and tasks, then an

answer becomes clearer. These tasks can be accomplished using any mobile device based on the descriptions and details provided by the literature and survey. The tasks are as follows:

- Accessing academic information easier and faster
- Making notes easier and faster
- Making report writing easier and faster
- Surfing the Internet easier and faster
- Based on age, gender and tasks, the answers are as follows

For females aged 34-39: Tablets are ideal for females aged 34-39. Laptops are the preferred choice for females aged 40+. However, something is interesting to note, in that females aged 29-33 do not have a preference about what devices are used for learning.

Furthermore, females aged 24-28 have no concerns regarding devices; therefore, in those instances, the author concludes that there is no need for them to use devices for learning. Males aged 29-33 prefer laptops as do the males aged 40+. One of the justifications is that one mobile device can perform specific tasks better than another device.

The survey shows that devices are used for learning and that the most favourable devices for learning are laptops firstly, followed by tablets and finally, the smartphones. However, the preference for devices is dependent on the task.

The research participants have identified the preference of devices, and overall, laptops are the preferred type of mobile device for individuals. However, when adding variables such as gender, age and tasks, this can change. The answer to this question is supported by the literature and the data collected from the survey.

Why are mobile devices/apps used for formal learning?

From the previous questions, many kinds of apps are used for formal learning with Tools, Education, Books and communication types of apps used. Furthermore, laptops are identified as the preferred devices to use with these apps. So, this question attempts to find an answer as to why. Why are devices/apps used for formal learning?

There are many reasons for using devices, as previously stated using devices simplifies tasks and enables individuals to perform tasks at a faster rate than usual, streamlining the activity and learning.

Data reveals that the use of mobile devices can support formal learning. Furthermore, the results also agree that mobile devices can improve learning productivity. However, data from the literature expands the findings of the survey.

Literature commented on using communication apps and features such as the texting app to support individuals to understand language structure or using social media to create groups for collaborative work. Also, devices are used as journals and calendars, as many features and apps of the device(s) offer services such as booking appointments, recording activities and the like. In addition, as these mobile devices are mobile, portable, smaller and light enough to carry around with people, they enable people to learn from any location at any time formally.

There are also the multitasking abilities devices and apps offer to its users and individuals. Table 59 shows that multiple apps can be used to support formal learning, yet Table 30, Table 32, Table 36, Table 38 and Table 42 and Table 44 show that multitasking is performed so regularly and therefore supports individuals to further their studies, extending their knowledge base.

Also, the literature points out that devices can improve and enhance academic performance and influence formal learning productivity. Mobile devices increase and improve work rate, or formal learning productivity, enhancing and improving the work rate or learning productivity, by making things simpler and faster, which improves the learning performance. Using technologies such as VR and AR can create a positive attitude towards learning which in turn, improves productivity. Literature also commented about game learning and the effects that they have on people. These effects refer to cognitive processes and loads, which affects learning productivity.

Mobile devices and apps are used; the data provided answers to this question. However, the literature extended on the idea from the survey and offered a broad answer. Based on that, the idea of mobile devices being used to improve learning productivity as well as support learning is supported.

How is the mobile device used?

Literature divulges that mobile devices are built and embedded with a wide range of functions and features and that various components or tools are compacted into these portable devices. The data suggests that these devices can be used as learning tools or for entertainment.

The literature points out that, mobile devices can be used as a notebook (drawing pad), camera, diary or journal, recorder, GPS, library, eBook, editing tool for images, reports and other tools.

However, the survey addresses this question by asking if mobile devices are used for formal learning or if mobile devices are used for activities not related to formal learning, such as leisure. The results show that mobile devices are used for formal learning, though when adding gender and age into the mix, many females do use their devices for formal learning as do males.

Females aged 24-28 use devices very much for formal learning, as indicated in Table 9. 100% of females in this age group agree to this way of using their mobile devices. This is also similar to females aged 29-33 and the 34-39 age group of females. However, there are some answers from females aged 40+, indicating that they frequently use their devices for learning, and there is a larger quantity of females aged 40+ who use their devices for formal learning. Where males are concerned, the majority of males use their devices for formal learning. Survey reveals that more individuals use their mobile devices for non-formal learning, such as leisure (playing games, being entertained), and literature has stated that devices are mostly used for entertainment purposes.

In the context of formal learning, mobile devices are used as tools such as storage, as diary or journals, recorders, GPS, as a library, eBook, and for its editing tools for images and reports. However, mobile devices can be used in the same way in a non-learning way. Furthermore, the research shows that more individuals have indicated that their devices are used more for entertainment opposed to learning, and thus the author concludes that this question is supported.

6.1 Limitations

The limitations of the research are aspects of research methods that changed or impacted the analysis of findings that occurred from the research.

The following are the limitations that developed throughout the study of this research.

6.1.1 Sampling method

As stated previously, the convenience sampling method is a form of non-probability sampling method, meaning all participants were available for the survey according to their availability

or convenience. Additionally, convenience sampling is known to have high sampling error as well as the possibility of bias. When utilising the conventional method, the results may reflect and represent a specific set of individuals and not the whole population of individuals. Also, note that this form of sample method can lead to an over-representation or under-representation of a collective.

6.1.2 Small sample size and time effects

Smaller sample size set does not or cannot represent the entire population. Unfortunately, for this research, the desired sample size was not met and thus did not achieve statistical significance. Having a small sample size offers small results, which limits the tools and instruments for analysis. As well as affecting the reliability of the survey responses, it can also increase the variability, which could lead to bias.

The time available to the research and this study to satisfy the research question is restricted. The deadline of the assignment provided by the tertiary provider was limited, as the research topic required more time to complete the literature review, apply and test the methodology and finally, interpret the results.

6.1.3 Non-reliable sources

Using the resources available on the Internet, such as google scholar, the author found valuable and insightful information on the research topic. However, some papers or articles did not originate from credible sources, like journals, and were not peer-reviewed. These valuable sources could not be used for the research and thus were discarded.

6.1.4 Technical problems

The use of technology to support research projects does ease the researching process. As there is a wide variety of tools that are available to draw from, it makes composing reports and creating surveys a lot simpler. As well as analysing data, finding articles and books related to a research topic. However, technical problems cannot be avoided, as the author has experienced technical difficulties that hindered the flow of the research, such difficulties include, software incompatibilities, hardware and software malfunction, as well as data loss.

6.2 Possible refinements

Possible refinements for this research include data collection, data analysis and discussions.

Data collection. For this research, the author developed a survey and administered the survey using social media. After the collection was completed the author noticed that more questions were to be added onto the survey, adding additional questions could refine the results, also using other methods of distribution to extend the reach of the survey which in turn could increase participants that could lead to vital statistics.

Data analysis. With the data collection being a success, the author would use a wide range of tools and techniques available to analyse the data and test and validate the hypotheses. This would enhance and improve the entirety of the research and the analysis ability of the author.

Discussion. The discussion is the area the author uses to express his interpretations and understandings of the results. The author has noticed the difficulty to express his understandings of the results and thus needs possible refinements. Learning more about quantitative analysis and qualitative analysis and how to interpret these types of data would be beneficial to the researcher, as well as learning new skills to express the findings in the results.

6.3 Further application

To extend this research from the findings, investigation into the design and development of mobile devices and their apps. Looking into how indigenous people integrate and use mobile devices in their learning contexts and how tertiary providers can enhance their curriculum by fully utilising mobile devices in learning environments. Investigate the positive effects of multitasking across different demographics: ages, genders, ethnic groups.

6.4 Critical analysis on the research

Reflecting on the process of this research was an exciting experience to behold. There were various aspects and lessons learnt during the research. The information that was collected to compose this report was of great value, as many academic articles and current literature available have been read, examined and analysed to the best of the authors' current abilities to grasp an understanding of the research topic.

The development of ideas, hypotheses and questions that relate to mobile devices and learning to find and comprehend the effects and changes that occur when learning with mobile devices was a challenge to the author. Because this process required the author to transform the way in which the author thinks, which affected the way the author conveyed his ideas, interpretations and understanding. Furthermore, the author’s knowledge of theoretical

frameworks and conceptual models, worldviews, logical thinking and/or approaches (deductive and inductive), and research methods (quantitative and qualitative) have increased during the research due to following the research methodology.

The independent study was difficult most times; however, the experience was well worth it because the author has attained knowledge that he did not possess before this experience.

7 References

Adedoja, G., & Morakinyo, D. A. (2016). Gender influence on undergraduates students' acceptance of mobile learning instruction using Technology Acceptance Model (TAM). *Asian Journal of Education and e-Learning, 4*, 65-70.

Al-Hunaiyyan, A., Alhajri, R. A., & Al-Sharhan, S. (2018). Perceptions and challenges of mobile learning in Kuwait. *Journal of King Saud University - Computer and Information Sciences, 30*(2), 279-289. doi:https://doi.org/10.1016/j.jksuci.2016.12.001

Al-Zahrani, H., & Laxman, K. . (2016). A critical meta-analysis of mobile learning research in higher education. *The Journal of Technology Studies, 42*(1).

Ali, G., Mbabazi, B. P., Lawrence, N., & Geoffrey, A. (2017). Use of mobile devices by students to support learning in universities: a case of Muni University. *International Journal of Research in Engineering & Technology, 5*(6), 69-80.

Alsaadat, K. (2017). Mobile learning for higher and continuing education. *European Journal of Social Sciences Studies, 2*(6), 251-263.

Bacca, J., Baldiris, S., Fabregat, R., & Graf, S. (2014). Augmented reality trends in education: a systematic review of research and applications. *Educational Technology & Society, 17*(4), 133–149.

Balfagih, H. (2017). *A study of impacts of mobile devices on first-year university students.* Auckland University of Technology,

Becker, D. A., Pernsteiner, A., & Drum, D. (2018, 2018). *The impact of mobile device use.* Paper presented at the Learning Technology for Education Challenges, Cham.

Briz-Ponce, L., Pereira, A., Carvalho, L., Juanes-Méndez, J. A., & García-Peñalvo, F. J. (2017). Learning with mobile technologies – Students' behavior. *Computers in Human Behavior, 72*(2017), 612-620. doi:https://doi.org/10.1016/j.chb.2016.05.027

Brown, I. (2018). Gender differences in the use of smartphones and iPhones for language learning. *言語文化研究, 38*(1), 179-209.

Callum, K. M., Day, S., Skelton, D., & Verhaart, M. (2017). Mobile affordances and learning theories in supporting and enhancing learning. *International Journal of Mobile and Blended Learning, 9*(2), 61-73.

Castillo-Manzano, J. I., Castro-Nuño, M., López-Valpuesta, L., Sanz-Díaz, M. T., & Yñiguez, R. (2017). To take or not to take the laptop or tablet to classes, that is the question. *Computers in Human Behavior, 68*(2017), 326-333. doi:https://doi.org/10.1016/j.chb.2016.11.017

Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4 ed.). 501 Boylston Street, Boston, MA 02116: Pearson.

Creswell, J. W. (2013). *Research design: qualitative, quantitative, and mixed methods approaches* (4 ed.). 2455 Teller Road Thousand Oaks, California 91320: SAGE Publications.

Cromptona, H., & Burke, D. (2018). The use of mobile learning in higher education: A systematic review. *Journal of computers and education, 123*(2018), 53-64. doi:https://doi.org/10.1016/j.compedu.2018.04.007

Damyanov, I., & Tsankov, N. (2018). Mobile apps in daily learning activities. *International Journal of Interactive Mobile Technologies, 12*(6), 133-140. doi:10.3991/ijim.v12i6.9659

Davison, C., & Argyriou, E. (2016). Gender preferences in technology adoption: An empirical investigation of technology trends in higher education. *International Journal of Gender, Science and Technology, 8*(3), 405-419.

Dunleavy, G., Nikolaou, C. K., Nifakos, S., Atun, R., Law, G. C. Y., & Tudor Car, L. (2019). Mobile digital education for health professions: Systematic review and meta-analysis by the digital health education collaboration. *Journal of Medical Internet Research, 21*(2), 1-17. doi:10.2196/12937

Easterbrook, S., Singer, J., Storey, M.-A., & Damian, D. (2008). Selecting empirical methods for software engineering research. In F. Shull, J. Singer, & D. I. K. Sjøberg (Eds.), *Guide to Advanced Empirical Software Engineering* (illustrated ed., pp. 285-311). London: Springer London.

Eppard, J., Nasser, O., & Reddy, P. (2016). The next generation of technology: Mobile apps in the English language classroom. *International Journal of Emerging Technologies in Learning (iJET), 11*(04), 21-27.

Farley, H., Murphy, A., Johnson, C., Carter, B., Lane, M., Midgley, W., . . . Koronios, A. (2015). How do students use their mobile devices to support learning? A case study from an Australian regional university. *Journal of Interactive Media in Education, 2015*(1), 1-13.

Fathema, N., Shannon, D., & Ross, M. (2015). Expanding the technology acceptance model (TAM) to examine faculty use of learning management systems (LMSs) in higher education Institutions. *Journal of Online Learning and Teaching, 11*(2), 210-232.

Ferial, K., Wolfgang, M., & Kim, F. (2016). Advancing mobile learning in formal and informal settings via mobile app technology: Where to from here, and how? *Journal of Educational Technology & Society*, *19*(3), 16-26.

FitzGerald, E., Ferguson, R., Adams, A., Gaved, M., Mor, Y., & Thomas, R. (2013). Augmented reality and mobile learning: The state of the art *International Journal of Mobile and Blended Learning, 5*(4), 43-58.

Fojtik, R. (2015). Ebooks and mobile devices in education. *Procedia-Social and Behavioral Sciences, 182*(2015), 742-745.

Fojtik, R. (2017). The Use of Mobile Devices in Education. *New treands and issues Proceedings on humanities and scial science, 3*(3), 41-47. doi:https://doi.org/10.18844/gjhss.v3i3.152

Foti, M. K., & Mendez, J. (2014). Mobile learning: how students use mobile devices to support learning. *Journal of Literacy and Technology, 15*(3), 58-78.

Gikas, J., & Grant, M. M. (2013). Mobile computing devices in higher education: Student perspectives on learning with cellphones, smartphones & social media. *The Internet and Higher Education, 19*(2013), 18-26.

Göksu, İ., & Atici, B. (2013). Need for mobile learning: Technologies and opportunities. *Procedia - Social and Behavioral Sciences, 103*(2013), 685-694. doi:https://doi.org/10.1016/j.sbspro.2013.10.388

Grant, M. (2015). Using mobile devices to support formal, informal and semi-formal lrning. In *Emerging Technologies for STEAM Education* (pp. 157-177): Springer.

Grant, M., & Hsu, Y.-C. (2014). Making personal and professional learning mobile: Blending mobile devices, social media, social networks, and mobile apps to support PLEs, PLNs, & ProLNs. *Advances in Communications and Media Research Series, 10*, 27-46.

Grimus, M. (2014). Mobile Phones and Gender. Chances and Challenges in Education around the World. *Gender and Education from Different Angles, 22*, 184-203.

Hamdani, D. S. A. (2013). Mobile learning: A good practice. *Procedia - Social and Behavioral Sciences, 103*(2013), 665-674. doi:https://doi.org/10.1016/j.sbspro.2013.10.386

Hamidi, H., & Chavoshi, A. (2018). Analysis of the essential factors for the adoption of mobile learning in higher education: A case study of students of the University of Technology. *Telematics and Informatics, 35*(4), 1053-1070. doi:https://doi.org/10.1016/j.tele.2017.09.016

Hashim, K. F., Tan, F. B., & Rashid, A. (2015). Adult learners' intention to adopt mobile learning: A motivational perspective. *British Journal of Educational Technology, 46*(2), 381-390.

Haßler, B., Major, L., & Hennessy, S. (2016). Tablet use in schools: A critical review of the evidence for learning outcomes. *Journal of Computer Assisted Learning, 32*(2), 139-156.

Heflin, H., Shewmaker, J., & Nguyenne, J. (2017). Impact of mobile technology on student attitudes, engagement, and learning. *Journal of computers and education, 107*(2017), 91-99.

Ismail, A.-R. (2014). *Research methodologies in information technology research: A comparative study*. Retrieved from

Jamali, S. S., Shiratuddin, M. F., Wong, K. W., & Oskam, C. L. (2015). Utilising Mobile-Augmented Reality for Learning Human Anatomy. *Procedia - Social and Behavioral Sciences, 197*(2015), 659-668. doi:https://doi.org/10.1016/j.sbspro.2015.07.054

Johnston, K. A. (2016). The use, impact, and unintended consequences of mobile web-enabled devices in university classrooms. *Issues in Informing Science and Information Technology, 13*, 025-046.

Jubas, K. (2010). Everyday scholars: Framing informal learning in terms of academic disciplines and skills. *Adult Education Quarterly, 61*(3), 225-243. doi:10.1177/0741713610380444

Judd, T. (2014). Making sense of multitasking: The role of Facebook. *Computers & Education, 70*(2014), 194-202. doi:https://doi.org/10.1016/j.compedu.2013.08.013

Junco, R. (2012). In-class multitasking and academic performance. *Computers in Human Behavior, 28*(6), 2236-2243. doi:https://doi.org/10.1016/j.chb.2012.06.031

Junco, R., & Cotten, S. R. (2012). No A 4 U: The relationship between multitasking and academic performance. *Computers & Education, 59*(2), 505-514. doi:https://doi.org/10.1016/j.compedu.2011.12.023

Kim, J. H., & Park, H. (2019). Effects of smartphone-based mobile learning in nursing education: A systematic review and meta-analysis. *Asian Nursing Research, 13*(1), 20-29. doi:https://doi.org/10.1016/j.anr.2019.01.005

Kitchenham, B., Charters, S., Budgen, D., Brereton, P., Turner, M., Linkman, S., . . . Visaggio, G. (2007). *Guidelines for performing systematic literature reviews in software engineering*. Retrieved from

Klimova, B., & Poulova, P. (2016). Mobile learning in higher education. *advanced science letters, 22*(5-6), 1111-1114.

Kopáčková, H. (2014). *Preparedness for mobile learning at higher education.* Paper presented at the The 10th International Conference on Digital Technologies 2014.

Kuboye, B. M., Oloja, S. V., & Obolo, O. A. (2014). Impact of mobile devices on learning in Akure. *European Journal of Engineering and Technology, 2*(2), 45-58.

Kumar, B. A., & Mohite, P. (2018). Usability of mobile learning applications: a systematic literature review. *Journal of computers and education, 5*(1), 1-17.

Miller, H. B., & Cuevas, J. (2017). Mobile Learning and its effects on academic achievement and student motivation. *International Journal for Scholarship of Technology Enhanced Learning, 1*(2).

Mtega, W. P., Bernard, R., Msungu, A. C., & Sanare, R. (2012). Using mobile phones for teaching and learning purposes in higher learning institutions: The case of Sokoine University of Agriculture in Tanzania. *Proceedings and report of the 5th UbuntuNet Alliance annual conference*, 118-129.

Munday, P. (2016). The case for using Duolingo as part of the language classroom experience. *RIED: revista iberoamericana de educación a distancia, 19*(1), 83-101.

O'Connor, S., & Andrews, T. (2018). Smartphones and mobile applications (apps) in clinical nursing education: A student perspective. *Nurse Education Today, 69*(2018), 172-178. doi:https://doi.org/10.1016/j.nedt.2018.07.013

Onaolapo, S., & Oyewole, O. (2018). Performance expectancy, effort expectancy, and facilitating conditions as factors influencing smartphone use for mobile learning by postgraduate students of the University of Ibadan, Nigeria *Interdisciplinary Journal of E-skill and lifelong learning, 14*(2018), 96-115. doi:https://doi.org/10.28945/4085

Pedro, L. F. M. G., Barbosa, C. M. M. d. O., & Santos, C. M. d. N. (2018). A critical review of mobile learning integration in formal educational contexts. *International Journal of Educational Technology in Higher Education, 15*(1), 10. doi:10.1186/s41239-018-0091-4

Petersen, K., & Gencel, C. (2013, 23-26 Oct. 2013). *Worldviews, research methods, and their relationship to validity in empirical software engineering research.* Paper presented at the 2013 Joint Conference of the 23rd International Workshop on Software Measurement and the 8th International Conference on Software Process and Product Measurement.

Pimmer, C., Mateescu, M., & Gröhbiel, U. (2016). Mobile and ubiquitous learning in higher education settings. A systematic review of empirical studies. *Computers in Human Behavior, 63*(2016), 490-501. doi:https://doi.org/10.1016/j.chb.2016.05.057

Pramana, E. (2018). Determinants of the adaptation of mobile learning systems among university students in Indonesia. *Journal of Information technology Education: Research, 17*(2018), 366-398. doi:https://doi.org/10.28945/4119

Ramadiani, Azainil, Haryaka, U., Agus, F., & Kridalaksana, A. H. (2017). User satisfaction model for e-learning using smartphone. *Procedia Computer Science, 116*(2017), 373-380. doi:https://doi.org/10.1016/j.procs.2017.10.070

Samaha, M., & Hawi, N. S. (2016). Relationships among smartphone addiction, stress, academic performance, and satisfaction with life. *Computers in Human Behavior, 57*(2016), 321-325. doi:https://doi.org/10.1016/j.chb.2015.12.045

Sana, F., Weston, T., & Cepeda, N. J. (2013). Laptop multitasking hinders classroom learning for both users and nearby peers. *Computers & Education, 62*(2013), 24-31. doi:https://doi.org/10.1016/j.compedu.2012.10.003

Saunders, M., Lewis, P., & Thornhill, A. (2012). *Research methods for business students* (6 ed.). Harlow, United Kingdom: Peason.

Snell, S., & Snell-Siddle, C. (2013). *Mobile learning: The effects of gender and age on perceptions of the use of mobile tools.* Paper presented at the The second international conference on informatics engineering & information science.

Surbhi, S. (2018, January 25). Difference Between Research Method and Research Methodology. Retrieved from https://keydifferences.com/difference-between-research-method-and-research-methodology.html

Taleb, Z., & Sohrabi, A. (2012). Learning on the Move: The use of Mobile Technology to Support Learning for University Students. *Procedia - Social and Behavioral Sciences, 69*(2012), 1102-1109. doi:https://doi.org/10.1016/j.sbspro.2012.12.038

Van Raaij, E. M., & Schepers, J. J. (2008). The acceptance and use of a virtual learning environment in China. *Computers & Education, 50*(3), 838-852.

Vázquez-Cano, E. (2014). Mobile distance learning with smartphones and apps in higher education. *Educational Sciences: Theory and Practice, 14*(4), 1505-1520.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425-478. doi:10.2307/30036540

Wai, I. S. H., Ng, S. S. Y., Chiu, D. K., Ho, K. K., & Lo, P. (2018). Exploring undergraduate students' usage pattern of mobile apps for education. *Journal of Librarianship and Information Science*, *50*(1), 34-47.

WINTEC. (2019). Research skill. Retrieved from https://libguides.wintec.ac.nz/Library_research_skills/OneSearch

Wu, W.-H., Jim Wu, Y.-C., Chen, C.-Y., Kao, H.-Y., Lin, C.-H., & Huang, S.-H. (2012). Review of trends from mobile learning studies: A meta-analysis. *Computers & Education*, *59*(2), 817-827. doi:https://doi.org/10.1016/j.compedu.2012.03.016

Zydney, J. M., & Warner, Z. (2016). Mobile apps for science learning: Review of research. *Computers & Education*, *94*(2016), 1-17. doi:https://doi.org/10.1016/j.compedu.2015.11.001

8 Appendices

Data gathering instruments (interview questions, survey questions, experiments)

8.1 Ethics forms

Wintec WAIKATO INSTITUTE OF TECHNOLOGY Te Kuratini o Waikato	**Research and Postgraduate Office (RPGO)** **Human Ethics in Research Group (HERG)**

LOW-RISK HUMAN ETHICS IN RESEARCH APPLICATION FORM

Please refer to the Ethics Guidelines prior to completing this application.

The RPGO is located at the City Campus, D-Block (Offices D2.22 – D2.24), email research@wintec.ac.nz or phone Megan Allardice on Ext. 3582 for more information.

Please see the last page of this document for detailed instructions for completing this form.

1.0 PROJECT TITLE	
	The effects of mobile apps on learning

2.0 RESEARCHER(S)		
2.1	Primary researcher's name	Hohepa Mangu
2.2	School//Centre/Unit	Centre of Information Technology
2.3	Contact Details	027-5155446 hohman20@student.wintec.ac.nz

	(Telephone and E-mail)	
2.4	Is this application a:	☒ Student Application ☐ Staff Application
2.5	If this is a student application, please provide the Module code here	INFO901
2.6	Is this project a staff application that utilises work partially or wholly undertaken by students who are not participants (e.g. data collection undertaken by a researcher's class)?	N/A
2.7	If so, please clearly describe what the role of these students is to be in this research, what the work will be used for explicitly (including any issues regarding authorship of research outputs such as journal articles), and what steps have been taken to ensure students are aware of this.	N/A
2.8	Name of other Researcher(s) and positions. (If this is a student application please provide the name(s) of the project supervisor(s) and indicate that they are supervisors here.)	Hohepa Mangu Dr Kay Fielden
2.9	Contact Details of other researchers and/or supervisors	0275155446, hohman20@student.wintec.ac.nz

	(Telephone and E-mail)	
2.10	Is this application:	☒ A new application ☐ A subsequent approval request following a significant change to an already approved application

3.0 PROJECT TIMELINE	
	Projected start date for **<u>data collection</u>** *(once this ethics application is approved. Please note, projects can only begin once applications have been approved, regardless of the level of risk)*: March 20, 2019 Projected end date: June 20, 2019

4.0 PROJECT SUMMARY (please include your research purpose and objectives, methodology will be dealt with in Section 6)

The purpose of this research is to address factors apps have on individuals and the connection it has on learning. The objectives are to find out what those factors are, the connection the factors have with learning and individuals, the types of apps individuals use for learning support and leisure such as video streaming, gaming.

5.0 PROJECT METHODOLOGY (including methods for data collection)

Online survey constructed by survey monkey.

Questionnaires will be created with SurveyMonkey and will be distributed via online.

The population is 13,515. The aim is to get statistical significance with a sample of 575, a confidence interval of 4 with a 95% confidence level.

6.0 CONSIDERATON OF ETHICAL ISSUES AND PROCESSES

Please describe below the process that you have undergone in order to discuss and analyse the ethical issues present in this project. (For example, who have you consulted in regard to ethical issues or in completing the screening questionnaire and this Low Risk application)

Risk of harm

The online survey will not put the researcher(s), participants or other involved parties' harms ways. The survey will not cause any discomfort or embarrassment.

Informed and voluntary consent

All participants will have the freedom to partake in the survey as well as being age appropriate of 18 years and over. All participants are to be sound minded.

Privacy and confidentiality

The questions will now involve any investigation or sensitive information. All participants will be unidentified and anonymous.

Deception

There will be no deception of participants.

Conflict of interest

No conflict of interest for the researcher in any form.

Compensation to participants

There will not be payments or inducements to participants

Procedural

No outside organisation will be involved in this research.

Māori participants and other cultural considerations

Māori will not be the prime focus of this research. This research will not focus specifically on other ethnic groups nor rise cultural issues.

Health and disability

This research does not involve health and disability research

Researcher(s) signature(s) (the <u>name and signature</u> of all researcher(s) are to be included):		
Name	**Signature**	**Date**
Hohepa Mangu		

Primary Supervisor's signature (if this is a student application):		
Name	**Signature**	**Date**
Dr K Fielden		

Research Leader's signature:		
Name	**Signature**	**Date**

HERG Chairperson or delegated representative's signature (RPGO use only):		
Name	**Signature**	**Date**

COMPLETING THIS FORM

Please note: A low risk research project is one in which the nature of the potential/actual risk of harm to participants or the researcher is minimal and no more than is normally encountered in daily life. If, as a staff member, you are new to research or are in any doubt as to which application to submit, please consult with your Research Leader. If you are a student, your supervisor will be able to give you advice. If you are still in any doubt, don't hesitate to consult the RPGO.

Specific Instructions

- All questions are to be answered. Note the questions within require a mix of descriptions, yes/no answers and cross the box (**Double-click on check boxes with your mouse and select 'Checked' from the options under 'Default Value'**).
- Research Leaders need to review the information in this form and sign it off prior to application being made to the RPGO.
- Please forward one signed original copy to the RPGO, together with an electronic version to research@wintec.ac.nz.
- Low Risk Human Ethics in Research Applications also need to be accompanied by a copy of the Information Sheet, Consent Form, and any Questionnaires or Interview Schedules for consideration. If Questionnaires/ Schedules are not yet confirmed, please supply the latest draft.
- No questions are to be deleted, even those that you feel you are not required to answer.
- No part of the research requiring ethical approval should commence prior to approval being confirmed.
- Applicants will receive an official confirmation of submission via email from the RPGO once all conditions of this form have been completed.
- If you want to apply for an extension on a previously approved project, please contact the RPGO, as you will probably not need to submit a separate application.

- Applicants will be advised of the outcome of their application to the Human Ethics in Research Committee **no later than ten working days** after the completed and confirmed submission of this application.

HUMAN ETHICS IN RESEARCH LOW RISK APPLICATION FORM - CHECK LIST	
Research project title:	**The effects of mobile apps on learning**
Name of primary researcher:	**Hohepa Mangu**

Attached please find (as applicable) in the order listed below	
Completed HERG Low Risk Application Form	☒ Yes ☐ No

Consent Form for participants	☒ Yes ☐ No
Information Sheet for participants	☒ Yes ☐ No
Copy of Focus Group Questions, Interview Schedule, or similar	☒ Yes ☐ No

8.2 Survey questions

Survey Questions

Tēnā tātou

Thank you for considering participating in this research.

Your involvement in this research is voluntary. If you wish to be involved and participate in this research survey, know that, you can withdraw at any time.

No penalty will be issued if you don't want to participate or if you withdraw.

All responses will be confidential. Information that can personally identify you like names, addresses, phone numbers, ID numbers will not be collected.

The survey questions address mobile devices (e.g. phones, laptops etc) and learning with mobile devices.

If there are questions or comments about the research project, please contact me, Hohepa at hohman20@student.wintec.ac.nz.

By clicking the continue/agree/OK button, it's an indication that,

you have ready the above information,
you voluntarily agree to participate,
you are at least 18 years of age.

1. To which gender identity do you identify?

- Female
- Male
- Other

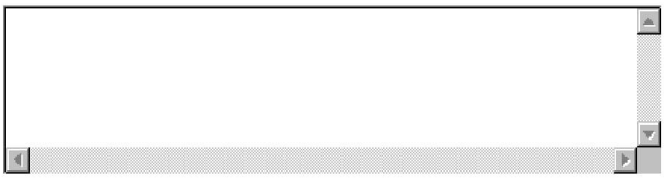
2. Please specify your age?

- 18-23
- 24-28
- 29-33
- 34-39
- 40+

3. How frequently are mobile devices (e.g. phones, laptop, tablets) used for formal studying?

- Very frequently
- Frequently
- Sometimes
- Not that much
- Not at all

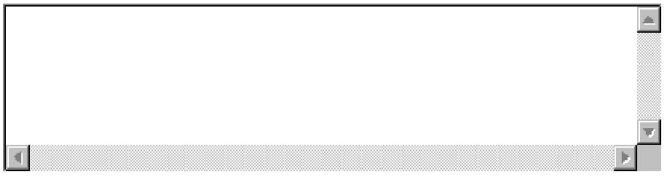
Any other comments (please specify)



4. How frequently are mobile devices (e.g. phones, laptop, tablets) used for leisure? (E.G. Playing music or games)

- Very frequently
- Frequently
- Sometimes
- Not that much
- Not at all

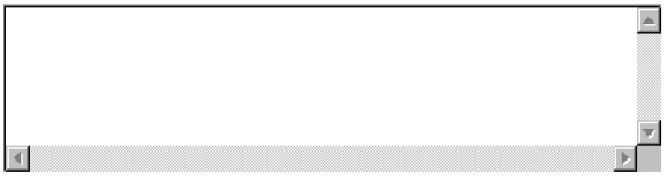
Any other comments (please specify)



5. In your experience, devices (e.g. phones, laptop, tablets) can be used to support formal learning.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

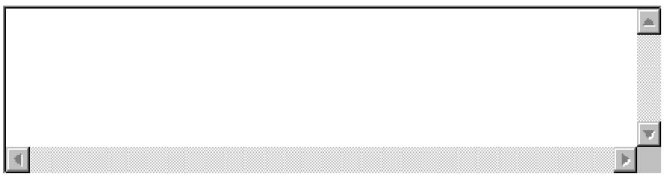
Any other comments (please specify)



6. In your experience, devices (e.g. phones, laptop, tablets) can improve formal studying productivity.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

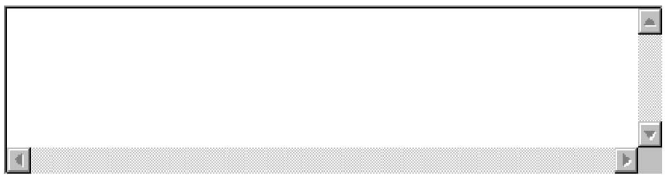
Any other comments (please specify)



7. In your experience, what types of apps can be used for formal studying? (Please select all that apply)

- ☐ Tools
- ☐ Games
- ☐ Business
- ☐ Education
- ☐ Photography
- ☐ Social media
- ☐ Music and audio
- ☐ Health and fitness
- ☐ Books & references
- ☐ Video players and editors

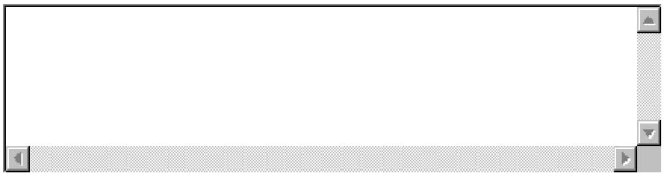
Any other comments (please specify)



8. In your experience, a smartphone is used for formal learning.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree
- N/A - Not applicable

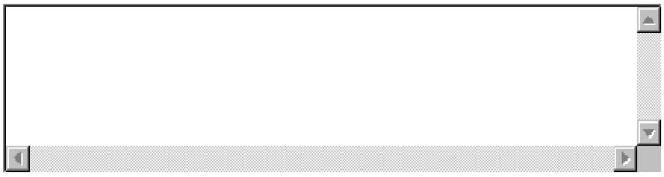
Any other comments (please specify)



9. In your experience, using a smartphone can,

- access academic information easier and faster.
- make note taking easier and faster.
- make report writing easier and faster.
- surf the internet easier and faster.
- N/A - Not applicable

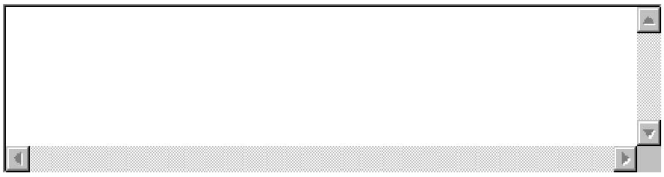
Any other comments (please specify)



10. In your experience, a tablet is used for formal learning.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree
- N/A - Not applicable

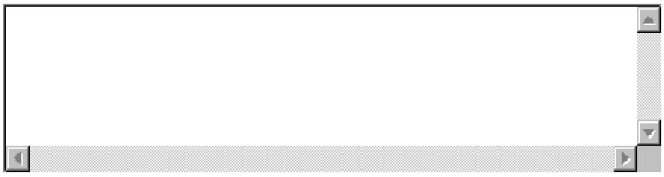
Any other comments (please specify)



11. In your experience, using a tablet can,

- access academic information easier and faster.
- make note taking easier and faster.
- make report writing easier and faster.
- surf the internet easier and faster.
- N/A - Not Applicable

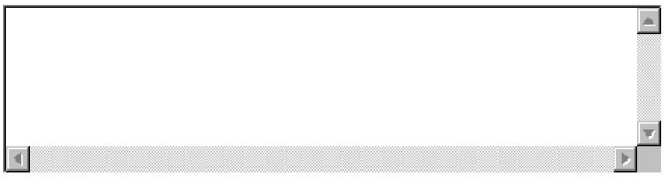
Any other comments (please specify)



12. In your experience, a laptop is used for formal learning.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree
- N/A - Not applicable

Any other comments (please specify)



13. In your experience, using a laptop can,

- access academic information easier and faster.
- make note taking easier and faster.
- make report writing easier and faster.
- surf the internet easier and faster.
- N/A - Not Applicable

Any other comments (please specify)